HELSENKI CENTRAL RAILWAY STATION

Lighting as part of the Urban Space and its Functions

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ABSTRACT
Topic of this thesis is the exterior of Helsinki Central railways station and the surrounding areas lighting as part of the Urban Space and its Functions and to present a new conceptual lighting design plan for the whole area.

The planning site is a complex multifunctional area, lacking in quality of light, security and a unified style of lighting missing a well established and maintained hierarchy of lighting design. The frontal area of the station including Kaivokatu is the busiest on the site. A more defined and consistent light is needed, complimenting the architecture and improving the safety of the users.

In order to find out how people experienced the site there was a need to look at the lighting in the area beyond the technical standards of illuminance levels and city guidelines. A user experience survey was performed in order to pick up key elements from the users’ point of view; results indicated a concrete need for a pleasant consistent cityscape, clarity of movement and increased safety. Current situation analysis was executed in order to get a technical and functional understanding for the area by measuring the luminance and illuminance values, colour temperature and colour rendering index. In order to create a final conceptual design, the process of lighting in the City of Helsinki including a breakdown of the various components, special rules and aims, were taken into account. The opportunities and constraints of the site were weighted and considered in the formation of the conceptual lighting design.

The new lighting plan is based on the possibilities of the area, the ease of navigation, safety and achieving the desired atmosphere. Creating a unified and a holistic dark-time look, which binds the station and the functions of the surrounding areas together. Ensuring the comfort and safety of commuters by improving the lighting also has a positive effect to the cityscape and enhances the overall movement in the area.
ACKNOWLEDGEMENTS
First I want to thank my thesis supervisors architect Pia Rantanen and the head of public lighting Juhani Sandström of the City of Helsinki’s Public Works Department. They always had the time to guide me in the process whether I have been in a troubling spot or had questions about my designs or writings. They have guided and made me feel confident that I’m on the right track.

Next I want to thank my professor Pentti Kareoja and my study coordinator Birgitta Tuomaala from Aalto University’s department of Design, Master’s Programme in Product and Spatial Design. Guiding me and giving me lots of support, I have been very lucky as a student under their care.

I would also like to thank all the experts involved in this process especially Anne Sipinen and Jyrki Sipinen, they have been very supportive and given me good insights in the technical part of lighting.

Last but not least I want to thank all my dear friends and family; mom and dad, my older brother Santtu and especially my little brother Joonas. They have been always there for me. I know it sounds like a cliche but I wouldn't have survived without their help after the car accident with everyday chores and in the healing process. All of that help and support has been very meaningful for me being able to continue and to finish this thesis. To my little brother I am forever grateful for his valuable comments on this thesis and for the supportive attitude that on one day I will get it done.
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1 INTRODUCTION
1.1 About the Author

Architecture and architecture lighting in the context of interior design and public spaces has always interested me and influenced my education and work choices so far. I’m trying to adopt varied approaches when designing in differing contexts, respecting how the variety of design disciplines support each other. Because I have a broad range of professional and educational experience, it allows me to approach a wide variety of design problems with the appropriate methodology. My background includes experience and education in the fields of interior architecture, furniture, graphic and lighting design.

The past few years I have lived and worked abroad in larger cities than Helsinki. Living in Shanghai and Vancouver have taught me a lot about city scale and good functionality especially when you’re commuting in the middle of the rush hour. Nowadays I appreciate more about the overall atmosphere in transition hubs and their surroundings, and good lighting design has a lot to do with it.

This probably sounds like a cliche but the main reasons why I returned back to Finland was that I missed my family, friends and the seasonal changes, especially winter. I have always been fascinated by darkness and cold weather. Even when it’s dark outside there is always light somewhere, the light can be coming from the stars or from the street lights far away reflecting from the clouds. During the night-time you can play with the light and bring out things you want to highlight and hide everything else.

The City of Helsinki should have a well-designed holistic identity for lighting, a new way of thinking of light closer to the human experience. Living in the city should be more about focusing on the moments and the beauty rather than consuming our time without noticing what is happening around us. I believe that with good lighting design we can help to make it happen.
1.2 Helsinki Central railway station

The thesis topic is focusing on the exterior of Helsinki Central railways station and to the surrounding areas in the context ‘lighting as part of the Urban Space and its Functions’. Why I chose this to be my topic was because I have always loved to monitor people in such places where they are bypassing each others and heading somewhere else lost in their thoughts. Helsinki Central railway station is a place like this and it has a lot of history and architectural value to Helsinki city and the cityscape. For this reason it’s not irrelevant how a place like this is lighted. Good lighting design makes it possible for people to orientate in the space, helps to make it well functioning and safe, complimenting the aesthetics values.

Railway stations are for people to rendezvous, in such places you can see the whole spectrum of life. The arrivals and leavings bring lot of mental images for everyone; meeting again, saying their goodbyes to loved ones, new beginnings and a promise of new adventures. We all can sense the atmosphere with our senses; how the station is lit, movement of people and vehicles, all the various sounds, the rhythm each individual place has on the whole.

1.2.1 Description and Background

Helsinki Central railway station is an internationally known icon of Finnish architecture, designed by Eliel Saarinen in 1909 and opened in 1919\(^a\). The station for the most part is clad in Finnish granite. A copper plated roof patinated to light green over the years. The station’s most iconic features are the clock tower and two pairs of statues holding spherical lamps on both sides of the main entrance\(^b\).

Before the Central railway station we know now, existed almost on the same spot a stone station building designed by the architect Carl Albert Edelfelt. The first railway station in Helsinki, built in 1860, the same year when The Grand Duchy of Finland built the very first railway between Helsinki and Hämeenlinna\(^c\).

As Helsinki city and the popularity of railways grew larger, the station turned out to be too small for the needs of the city. In the year 1903 The Railway Board organised a contest for architectural plans of a new station to be built. The contest received 21 entries in total and was won by Eliel Saarinen. His design proposal was a purely national romanticist, this caused a debate about the architecture of major public buildings with demands for a modern rational style. After the debate Eliel Saarinen abandoned his original romanticist design proposal and re-designed the station completely. He finished the new late Art Nouveau design in 1909, it took ten more years before the station was officially opened\(^d\).
The Central railway station has been renovated periodically to respond to the needs of a growing city or after encountering accidents. During World War 2 the station was damaged from air raid bombings of the capital. In 1950 the station survived a devastating fire. The fire did not require any human lives but caused huge damages mainly to the station’s attic.

Between the years 1955-1957 the exit hall to Railway Station Square was divided with an intermediate ceiling. During this timeframe seven floors for the use of the kitchen department were built inside the clock tower, and in the almost unused basement were placed storage and social facilities. In 1958, ticket sales opened in the former 3rd class restaurant and waiting room areas. In the 1960’s, the underground tunnel of ‘Asematunnelli’ was built.

The station’s underpass tunnel to Kaisaniemi Park and corner of Eliel Square was built in 1999-2000, designed by architect Jarmo Maunula. The tunnel is 185 meters in length and more than seven meters wide. It combined all the tracks together with staircases and lifts.

To the Station’s West side where the former railway freight yard used to be was built a new underground indoor parking hall and on top of it the Eliel Square bus terminal. The new bus terminal opened in October 2000. New platform tracks 17-19 were introduced one month before.

Helsinki Central railway station was for a long time the only major European railway station where passengers had to wait for a train under open sky conditions. The covering of the platforms had been planned since the station was opened but the glass canopy was finally completed in 2001, giving the station its current form. Preceded by a design contest held in 1994 and won by the architect Esa Piironen.

The West wing of the station was renovated into a commercial business center in the autumn of 2003. After the renovation people have access from the station hall to the end of the west wing by an aisle lined with restaurants and businesses, where the western commuter train departure tracks are located. During this period the State Railways pension fund built to the Northern edge of Eliel Square a hotel and an office building, which extends over the Western commuter departure platforms. The building was designed by the architectural firm ‘Arkitehtityöhuone Arto Palo Rossi Tikka Oy’, completed in 2003. The materials used in the facade were glass, patinated copper and green granite.

In 7th of June 2010 the station got the name we now know; ‘Helsinki Central railway station’, before the new name the station was known as ‘Helsinki railway station’. Helsinki Central railway station is the City of Helsinki’s most important public transport hub with access to the metro, train, bus and the tram. Near the station are several taxi stops and bicycle paths. In the station’s proximity is reserved parking space for passengers and bicycles. In front of the station is a private parking space where taxis can pick-up and leave passengers, nearby is more parking space for private cars.
Helsinki Central railway station has in total 19 Platforms for local and long-distance trains. Four large visible entrances to the Metro system which contain a single forked line. Nine tram lines pass the station from Kaivokatu, several dozens of local and regional buses with passenger access points from Eilie Square or the Railway Station Square. There is a possibility of transport from Elie Square and the Railway Station Square by bus or by train from the station to Helsinki-Vantaa Airport which is the main international airport of the Helsinki metropolitan region and of Finland².

To give an idea about the movement of people and traffic in the area and the surrounding areas; approximately 200,000 passengers are serviced by the station per day and the number is growing day by day¹.
1.3 Vision & Goals

Helsinki Central railway station and the surrounding areas new outdoor lighting’s objective is to facilitate the movement and orientation of pedestrians and the improvement of safety. Due to the importance of the site to the city, the aim is also to improve the image of Helsinki in the international stage with suitable energy efficient lighting.

Planning aims to prevent obtrusive or unnecessary light. A key aim is to ensure commuters the comfort and safety of their stay and movement in the site. The lighting design will also take into account the accessibility requirements for all user segments.

The new lighting plan will follow Helsinki city’s outdoor guidelines.
1.3.1 Planning area

The planning area includes the Railway Square, Elie Square, the Station Square and Kaivokatu, the plan also takes into account the areas surrounding it; buildings such as the CityCenter (Makkaratalo), Sokos, Ateneum, The National Theatre, including the leading street views.

One of the focus points will be the main entrances to the Helsinki Central railway station, and the entrances to metro and pathways to the tram lines.

Because the planning site forms a multi-functional, architectural and historical entity with one of the biggest challenges; the number of different modes of transport nodes and a large number of pedestrians. The new lighting plan must endeavour to orientate pedestrians and other traffic without forgetting safety, unity and harmony.
1.3.2 The Role of Light

General starting point for the lighting design is to enable the ability to perceive space, location and the objects within and the importance of visibility at night. The main focus point for lighting stems from the needs of the pedestrian; orientation and the ability to conceptualize space. Without forgetting Helsinki Central railway station’s and its surroundings importance to the cityscape of Helsinki.

The plans lighting scheme will be custom build for the space and its architecture based on people’s functional and aesthetic needs. In addition to the basic criteria of lighting, one of the main purposes is to create an atmosphere and a look guided by the users experience of the site.

Light’s role is to bring out, display, and structure the present and to ensure uninterrupted function during periods of darkness. Lighting methods and illumination are based on this definition of design.

The main objective of the plan is to create an easily observed space in a very challenging functional urban space with modern lighting methods.

1.3.3 The Experience of Space

The experience of space is created by the encounter of light and materials, combined with the movement and actions of human beings in space. With our senses we create an overall understanding of space, the objects within it as well as emotions evoked. Light makes the space and its forms visible to the naked eye, with the addition of sound and scent.

The Helsinki Central railway station and its’ surroundings

Helsinki Central railway station is a well-known and easily recognizable landmark even from a distance. The station can not be seen in its entirety from the perspective of a pedestrian therefore it is difficult to outline the shape of the building from street level alone. The stations architecture supports the movement and helps to orientate commuters to the entrances giving clarity to the chaos. The main entrance is a shining beacon of Art Nouveau with its most distinguishable feature; the two pairs of statues holding the spherical lamps. The station has three main entrances, the other two are located on its Western and Eastern sides and still very close-by to the front facade which keeps the movement of people consistent.
In front and on the Western side from the station are located three entrances to the metro which are lit at night-time. The majority of Helsinki’s tram routes pass the front of the station on Kaivokatu. Kaivokatu is one of the busiest streets in Helsinki not only because of the tram stops, but also because buses and other transportation goes through it. Kaivokatu is known by its many high traffic crossroads, dimly illuminated by the glow of traffic lights drowned by the pale yellow light of old high pressure sodium street lamps giving a muddled lighting scheme. Due to its heavy traffic nature, clear lighting scheme is instrumental for the safety of its users.

On the East side of the station is the Railway Square, which is bordered from the South by Kaivokatu, from East by Mikonkatu, by Vilhonkatu from North and to its West by the station. In line with the Railway Square are many historically and architecturally significant buildings, including the Ateneum Art Museum located at the Southern edge of the square and the Finnish National Theatre located on the Northern edge of the square. In the middle of the square stands the statue of Aleksis Kivi. The Square itself doesn’t have much activity outside of normal use, during the winter months there is an ice rink and at times there are some organized events but most of the year it is empty.

The East side of the station has very different architectural style and epoch compared to the Eastern side where Eliel Square is located, both areas function as platforms for departures and arrivals of public transports and taxies. Eliel Square has a more ‘modern look’ compared to the architecture of the station.

At Eliel Square’s Northern end is a hotel just East of the railway station. At the Southern end between Eliel Square and Station Square is a restaurant, on the West side of it is Postitalo; a yellow shaded functionalist building which houses a grocery store, library and a post office. The City of Helsinki has also reserved a space for mobile food kiosks; ‘Ketterät kioskit’ freely translated as ‘Agile kiosks’. At the North side of the station is Sanomatalo, a modern glass-walled business and office building.

All the street openings to the station have a different nature and experience to them, only revealing a glimpse of the station. As a whole, the station and its surroundings lack a unified coherent space, the colour temperatures and brightness of the light varies in the night-time furthering the sense of disharmony. The lighting of business and office buildings are combating the street lights of different sizes in different heights.
MAP VIEW OF THE SITE

- Helsinki Central railway station’s facades
- Helsinki Central railway station’s main entrances
- Ateneum’s & National Theatre’s facades
- Main Business buildings’ facades
- Railway Square
- Eliel Square
- Station Square
- Tram stops
- Front of the station
- Kaivokatu & Postikatu
- Mikonkatu & Postikuja
- Street openings
1.3.4 User Experience Survey

The user experience survey was done in March 2015 during the darkness of early spring-late winter.

The survey was done by ‘leg work’ at the site and at different locations of the area. I had the survey printed on papers and polled random people from all walks of life. For the purpose of getting the participants true opinions I avoided going into detail about its purpose.

The survey had seven different multiple choice questions with a possibility to comment on the choices made and one question for ‘focusing’ comments ‘what’ and ‘why’. The survey was done in Finnish with the possibility to answer in English too.

All the respondents answered to most of the questions, only in the last question where I asked only for comments did some of the respondents skip it completely. I gave them as much time as they wanted to use on each question and only afterwards I talked with respondents about the survey and what it was for.

During several days I managed to collect answers from in total of 31 respondents. Here I will introduce the questions and explain why I chose to ask such questions and how it will be helpful for this plan.
**Question No. 1**
Is Helsinki Central railway station and its surroundings familiar to you?
(Onko Helsingin päärautatieasema ja sen lähiympäristö sinulle tuttu?)

Respondents: 31
Skipped: 0

With this question ‘Is Helsinki Central railway station and its surroundings familiar to you?’ I wanted to know how well the respondents knew the site and its surroundings as well as to know how it might affect their replies and comments on other questions.

The people whom I managed to poll knew the place well and only two respondents were not as familiar with the site as the other respondents. None of my respondents didn’t know the site at all.
**Question No. 2**

Is it easy for you as a pedestrian to move around at the Central railway station and its surroundings in the night-time?

(Onko päärautatieasemalla ja sen lähiympäristössä helppo liikkua jalankulkijana pimeään aikaan?)

Respondents: 31  
Skipped: 0

With the question number 2 ‘Is it easy for you as a pedestrian to move around at the Central railway station and its surroundings in the night-time?’ I wanted to know how people experience the ease of movement as pedestrians around the area. In most cases the answer was ‘Most of the time yes’ and I got less answers from the negative side.

The reason for this was that most of the respondents already knew the area well. From the negative side I received comments about the bicycle paths which some found confusing due to them being inefficiently marked and complaints of the poor planning of the pathways, also comments that the sidewalks for pedestrians were poorly marked leading to complaints about people walking aimlessly because of it.
QUESTION NO.3

With this question ‘Is it easy to find your destination etc. at the Central railway station and its surroundings in the night-time?’ I wanted to know how well people can perceive the space and navigate within it from point A to point B as well as their ability to locate the various establishments around the area.

In most cases the answer was ‘Usually, I can find’ and again I got less answers from the negative side. Again the reason for this was that the respondents already knew the area well. From the negative side I got comments from some of the respondents who had to guide tourists often on the site because the lack of signs and complaints about the poor clarity of bus stop information boards due to poor illumination.
**Question No. 4**
Do you feel that Helsinki Central railway station and its surroundings are safe after dark?
(Koetko Helsingin päärautatieaseman ja sen lähiympäristön turvalliseksi pimeään aikaan?)

<table>
<thead>
<tr>
<th>Response</th>
<th>In total</th>
<th>Responses in %</th>
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</thead>
<tbody>
<tr>
<td>I do not feel (En koe)</td>
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<tr>
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<td>I cannot say (En osaa sanoa)</td>
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<td>I do feel always (Kyllä koen aina)</td>
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Respondents: 30
Skipped: 1

With this question ‘Do you feel that Helsinki Central railway station and its surroundings are safe after dark’ I wanted to get an idea about the respondents sense of safety in the area after sunset. In numerous studies sense of safety has been noted to decrease when less light is available or the light is artificial and leaves areas unlit.

Most of the respondents replied ‘Usually, I do feel’ safe to the question, twenty percent felt that they didn’t feel safe at all and other twenty percent that they rarely do. The reason for positive responds was in most of the cases that at the site there are always people there giving the notion that nothing ‘bad’ can happen and also due to their familiarity of the area over the years without negative incidents happening to them. Some of the respondents commented that they feel safe despite the reputation of anti-social behaviour in the area during the weekends and late in the evenings because they know how to handle those type of situations. The same respondents also said that they avoid spots where there are fewer numbers of people and going through tunnels or more quiet streets and paths. Couple of the respondents mentioned that they avoid the area completely during the night-time.
Question No. 5
How do you feel about traffic safety around Helsinki Central railway station and its surroundings during the dark?
[Koetko Helsingin päärautatieaseman ja sen lähiympäristön turvalliseksi liikenteen puolesta pimeään aikaan?]

Respondents: 30
Skipped: 1

1. I do not feel (En koe)
2. Rarely, I do feel (Koen harvoin)
3. I cannot say (En osaa sanoa)
4. Usually, I do feel (Koen useimmiten)
5. I do feel always (Kyllä koen aina)

With the question ‘How do you feel about traffic safety around Helsinki Central railway station and its surroundings during the dark?’ I wanted to know about the respondents sense of safety when there is less light available but with traffic still around.

Most of the respondents answered that they usually feel safe and 30% of the respondents said that they do not feel safe.

I got more comments from the negative side especially from the view point of cyclists, they noted the difficulty of perceiving other people on the pathways. The comments from the positive side were about the sufficient amount of traffic lights and drivers seem to respect them but in the other hand they still felt the need to be more alert when crossing the streets.
**Question No. 6**

*What do you think about Helsinki Central railway station and its surroundings (exterior) general lighting?*

[Mitä mieltä olet Helsingin päärautatieaseman ja sen lähiympäristön (ulkopuolisesta) yleisvalaistuksesta?]

Respondents: 31
Skipped: 0

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<td>Satisfactory (Tyydyttävä)</td>
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<td>Good (Hyvä)</td>
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<td>Excellent (Erinomainen)</td>
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**Question No. 6**

With this question *What do you think about Helsinki Central railway station and its surroundings (exterior) general lighting?* I wanted to get an idea how the people feel about the lighting and did they find it aesthetic.

Most of the responses were from the negative side and in between, only sixteen percent answered that it’s good and none replied that it is excellent.

Most of the comments complained about the bad lighting lessening the image of the beautiful railway station and its surroundings. The respondents also felt that there should be more lighting and sometimes there are over illuminated spots with too much glare. Some of the respondents haven’t thought about the lighting before and to them it seemed like there was enough of it without going into any detail. The respondents also felt that the lighting doesn’t seem to be consistent and it’s mostly dull looking, they hoped for more ‘light installations’ to bring some life to the area. There were also complaints about the Eastern side of the station of it being under-lit.
**Question No. 7**

Is Helsinki Central railway station and its surroundings' atmosphere acceptable, or in other words, how do you enjoy the ambience? Please rate in school grades 4-10.

(Onko Helsingin päärautatieaseman ja sen lähityspäristön tunnelma mielestäsi sopiva eli toisin sanoen kuinka hyvin viihdyt täällä? Arvioi kouluarvosanoin 4-10?)

**Respondents:** 31  
**Skipped:** 0

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</tr>
<tr>
<td><strong>In total</strong></td>
<td></td>
<td><strong>31</strong></td>
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</tbody>
</table>

In the question number 7 I asked people to rate the atmosphere and how they felt about it in school grades from 4 to 10. Asking by school grades I wanted to get simple measurable answers, the school grade system is familiar to everyone and easy to understand.

The school grade average came to 6.35. The low grades were given because the respondents didn't think that the atmosphere was appropriate for the historical site. The respondents also found the area hectic and that the traffic there was overpowering, pedestrians being only a secondary priority. The respondents also complained about the general outlook of the area as shabby and outdated, some of the respondents didn't find it as a problem because they only went there to get somewhere and not to stay. The respondents were also hoping that the area could be more like Continental Europe or have more personality.
Question No. 8
Would you like to change lighting conditions in Helsinki Central railway station and its surrounding's, and if so why?
[Haluaisitteko muuttaa jotakin Helsingin päärautatieaseman ja sen lähiympäristön valaistuksessa ja jos haluatte, niin miksi?]

What I'd like to change: comments in total 27
Why would I want to change: comments in total 22

QUESTION NO. 8
I asked the question eight ‘Would you like to change lighting conditions in Helsinki Central railway station and its surrounding’s, and if so why?’ because I wanted to know what they think is wrong or lacking in the area.

The respondents wanted the area to have more modern looking lighting methods and to get rid off ‘ugly’ looking streetlights, some of the respondents wanted to change the ‘yellow-light’ to something that doesn't give a ‘sickly feeling’. The respondents wanted better lid main entrances, better illumination for the station's facades and for the other buildings in the area. People also wanted to get rid of dark spots and corners, have more light for pedestrians and make the bicycle paths more visible.

The answers ‘why’ they wanted to change something were intriguing. Most of the answers were about the sense of safety and that they wanted to improve it by lighting. Some of the respondents found it threatening that they cannot see well enough if there are people close by or not. The respondents also commented that the area doesn’t look pleasant during night-time and that the buildings are badly lit for their historical value and the illumination for the other buildings makes the area look ‘less friendly’ and this should be improved.

Why this survey was done and how it will be helpful for this plan
I wanted to do this survey so that I could get an idea how other people see the area and how it differs from mine and to get a general sense of the things that are lacking in the area as well as what is already good and balanced.

At the beginning of this survey it became evident from the responses that most hadn’t thought much about the area’s lighting and the methods of it, but simply viewed it as a ‘necessary evil’. The further they were questioned about the lighting the more it raised similar comments from the respondents about the need for change in the atmosphere, ideas for improving safety through lighting as well as for the ease of movement and navigation.

By making this survey I can now pick up the key elements from the users’ point of view. There is a need to look at the lighting in the area beyond the technical standards of illuminance levels and city guidelines. The survey tells us that for the users experience these are not enough for a pleasant consistent cityscape, clarity of movement and safety.
1.3.5 Why this development is important and what it can do for the city

Overall the experience of space in Helsinki Central railway station and its surroundings is complex, not only because of all the different functions but also because it’s lacking a unified style of lighting that could bring the site together which will establish and maintain a hierarchy of good lighting design. A more defined and consistent light which also compliments the architecture and improves safety of the users is needed.

The new lighting plan should be based on the possibilities of the area, the ease of navigation as well as the desired dark time experience. The aim is to create a unified and a holistic dark-time look, which will bind the station and its surrounding area’s functions together. The site is centrally located in the city and improving the lighting will have a positive effect to the cityscape.
2
THE PLANNING FRAMEWORK
2.1 Research & Analysis

This section includes an introduction to a couple of architectural lighting case studies from London, New York and Helsinki. The King’s Cross Square in London and The High Line in New York case studies were chosen because they have some similarities with my own planning site or an interesting implementation of illumination. Helsinki case study is about Kruunuvuorenranta's lighting design masterplan proposal called ‘Luonnon lyhdyt’ (Nature’s lanterns) which was one of the winners in the international competition for the creation of a lighting masterplan for the site in 2012. ‘Luonnon lyhdyt’ was chosen to be further developed and I used it here because the scale of the plan was unprecedented in the City of Helsinki.

This section is also a closer look at the actual site and its various elements illustrated with isometric diagrams and photos and a more detailed examination of the elements and structure, as well as a brief overview of the planning process of lighting in Helsinki including a breakdown of the various components, special rules and aims. The section also includes technical diagrams about the current lighting situation of the site, research and analysis of the development process as well as the design elements that have to be considered in the final lighting design for the site.
2.1.1 Architectural Lighting Case Studies

King’s Cross Square, London, the United Kingdom

The King’s Cross Square [7,000m²] is part of the King’s Cross Redevelopment Programme for the whole King’s Cross Central area. The area has a rich mix of commercial, cultural and residential buildings and a very busy transportation hub called King’s Cross Station, designed in the year 1852 by Lewis Cubitt. The station is located right next to the King’s Cross Square.

The King’s Cross Square has similar kind of urban challenges as my own planning site. The Square forms a focal point at the heart of a bigger district and has many transport interchanges; beneath the Square is a complex of London Underground structures, the Square also acts as an arrivals concourse area for the King’s Cross Station.

Stanton Williams architecture office executed the new architectural design for the King’s Cross Square. Speirs + Major did the lighting masterplan for the King’s Cross Central which was completed in the year 2007, they also supervised that the masterplan followed the final lighting design. StudioFRACTAL did the final lighting scheme for the Square in 2013.

The Square’s new lighting design had to balance the safety requirements for pedestrians, cyclist and other traffic as well as take into account the industrial heritage of the site. The design was based on the idea of maximising visuality of the King’s Cross Station. The new lighting scheme uses only LED technology, a first of its kind in such a large scale in the history of United Kingdom. The reason to use only LED technology was to reduce energy consumption and have a longer life span for the luminaires.

The end result of the new lighting design responds well to the multiple challenges that the Square has. It provides a visually well balanced orientated environment of gentle darkness and light. The new lighting design defines well the objects and gives to the facade of the station an aesthetically pleasing and functionally working ‘look’.
Images provided by Mark Kemp, Kemps Architectural Lighting, Leeds, United Kingdom.
High Line, New York, the United States

High Line is a 2.3-kilometre-long defunct rail line in the heart of New York City, also known as the High Line Park. The new modified architecture design was planned by Diller Scofidio + Renfro and James Corner Field Operations designed the landscape architecture for the site. The project was completed in 2009.[5a]

The structure of the High Line runs along Manhattan’s West Side. It’s an elevated section of a disused New York’s Central Railway line called the West Side Line. The Line is turned into a green promenade that is approximately ten meters above the streets below. The High Line carves through, passes underneath and goes between buildings. The lighting design’s concept was born from the desire to draw attention to these unique spatial relationships.[5b]

The general lighting strategy for this project has been divided into two. The lighting has sought to promote a clear view to the city and highlight details at night. By protecting the light sources and keeping most of the luminaires below the eye level, the view to the surrounding environment hasn’t been distorted. The lighting was also designed to create a low and consistent level of light along the length of the Line, giving an ‘illusion’ of the elevated tracks that seem to float over the city below. This effect is achieved with several light typologies; that at the same time provide visibility, security and unobtrusive lighting during the dark.[5b]

The High Line’s landscaped walkway is illuminated with a soft perimeter and linear lighting, both use LED technology, that creates a gentle glow to the plants and walkways. The lighting design is done in order to direct the attention of the pedestrians towards the surroundings and ease their orientation on the site. The illuminance levels of the lighting fixtures are kept on low levels. When the High Line passes through buildings, the lighting scheme changes to a fluorescent lighting. During daylight these ‘tunnels’ are illuminated with white light and by night time the light is blue.[5c]

The High Line’s lighting design is done in such a way that it is at the same time low levelled but highlights its surroundings and still stays interesting. The passage through the ‘tunnels’ gives nice change to the scenery during the night time and adapts to daylight by innovative multipurpose lighting design.
Top above: The tunnel at night. Above: Rendered lighting plan of the tunnel.

Top above: The pedestrian path. Above: A rendered light section through the High Line.
Kruunuvuorenranta, Helsinki, Finland

Kruunuvuorenranta is a new neighbourhood in the City of Helsinki and is currently under development. There used to be an old oil terminal which is now closed down in Kruunuvuorenranta and is now under re-development. The Kruunuvuorenranta district is located by the seashore, covering an area of 2.6km². The shoreline is six kilometres long with beautiful nature and old historical manor houses. The construction period started in 2013 and will be completed around the mid-2020's. Once finished, the district will contain a total of 5,000 to 6,000 housing units for 11,000 residents. Residential buildings will total around 500,000m² and business and services buildings around 50,000m².

City of Helsinki held an international competition for the creation of a lighting masterplan for Kruunuvuorenranta in 2012. The aim with the competition was primary to create a unique lighting masterplan for the area. The focus point was on the design of the Western shore as seen from a distance; from the city centre and the sea. The basis for the competition was the general area plan.

The City of Helsinki awarded two first prizes. The winning proposals were 'Into the Light' by the Austrian group Bartenbach LichtLabor GmbH and 'Luonnon lyhdyt' (Nature's lanterns) by the Dutch West 8 Urban Design & Landscape Architecture and British Speirs + Major Designers working with light. Both of the winning entries are mainly based on LED technology. In both entries the lighting has been designed so that the lights’ colour temperature and the amount of light can be controlled to adjust to the changing of the seasons and other lighting needs.

The concept for “Into the Light” proposal is strongly based on natural light, highlighting the different characteristics of the area in different seasons, and the balance of darkness and light being an important part of the overall lighting solution. The plan was designed so that it is viewed from outside the different subsections, varying degrees and functionally significant sites, works of art on the site and the light emphasised by the seashore.

“Luonnon lyhdyt” (Nature's lanterns) entry was based on; in the use of natural light, used materials on the site, the region's vegetation, the changes of the seasons and human activities. “Luonnon lyhdyt” entry is rich in detail and has experimental ideas. The plan emphasises light as a part of the community and as an instrument between the residents and the everyday environment.
Above: The Lighting Masterplan for Kruunuvuorenranta™.

Above: The Colour Temperatures™.
Above: Map of the Lighting Methods. 

Above: Map of the Maximum Mounting Heights.
Top above: Rendered landscape illustration of Ilonpuisto™. Above: Rendering of lighting in Haakoninlahti™.

Top above: Silo 468 art work, designed by Lighting Design Collective S.L™. Above: A detail from an intersection™.
In this architectural lighting case study about Kruunuvuorenranta I will focus on the lighting scheme and masterplan made by ‘West 8 Urban design & landscape architecture and Speirs + Major Designers working with light’ as it was chosen to be further developed by the City of Helsinki.

‘West 8 urban design & landscape architecture with Speirs + Major Designers working with light’ did the schematic design for Kruunuvuorenranta’s public realm and lighting. West 8 urban design & landscape did a report ‘Luonnollyhdyt’, Masterplan for Public Realm Kruunuvuorenranta part A in collaboration with Speirs + Major. In the report (part A) they explained the design of the public realm at shoreline and the adjacent areas for Kruunuvuorenranta. Speirs + Major made the complementary report of the lighting masterplan (part B). In these reports were pointed out that the area has a great potential of wealth in natural beauty and it should be taken into account in final execution of the development plan; based on the idea that the both masterplans (architectural and lighting) draws strength from the biodiversity and the neighborhood will derive its identity from it. The lighting scheme takes into consideration the long winter hours of darkness and the seasonal changes, the surrounding nature, existing material in the area and the future human activity. The agencies divided the area into nine focal areas, that division was mainly derived from the existing general area plan. They highlighted the natural qualities on the site but also combined with the urban nature of the area gives a unique characteristic to the site.

The plan appreciates natural darkness; minimises the use of artificial light and uses it in an intelligent and flexible manner. Having the right amount of light where it is needed and when it is needed. The design also plays with the scale and density of lighting, for example in the open spaces the light level can be quite low in order to enhance a more private and cosy environment.

The aspiration for the lighting scheme has been in branding Kruunuvuorenranta to a ‘neighbourhood of light’. The idea behind it is in making the ‘public light’ and the ‘private light’ as unified as possible.

The intensity of light diminish from the centre towards the North and the South. The horizontal and hemispherical illumination levels play an important part in enhancing safety, the vertical illumination focuses to create an ‘eye-pleasing’ environment and experience mainly for the residents and pedestrians’ point of view.

Most of the light sources follow the City of Helsinki’s general lighting colour temperatures which are set to 2700K-3000K and for the pedestrian paths and natural landscapes the colour temperature is 5000K in order to maximise the perceived brightness. The light sources are generally intended to be hidden and integrated. The Lighting fixtures have been mounted to promote the
human scale and to minimise glare. The mounting heights are also selected in order to optimise visibility of nature and distinguish residential areas from public ones. The plan also seeks to include space for ‘light art’. The idea is to create from Kruunuvuorenranta a landscape art work during the night time. The highlights of the area will be permanent and temporary lighting works of art.
2.1.2 Planning Framework

The existing legislation and norms do not precisely define the technical framework for urban lighting planning. Recommendations from international CIE (Commission International de l’Eclairage) and the Finnish national Illuminating Engineering Society (IES) of Finland (Suomen Valoteknillisen Seura) and The Association of Finnish Local and Regional Authorities (Kuntaliitto). Finnish Transport Agency (Liikennevirasto) work as guidelines for street and traffic illumination in addition to the existing legislation and The Public Works Department of Helsinki regulations. The City of Helsinki’s Public Works Department did a report on the lighting principles of Helsinki called ’Kaupungin valot’ in 2003 and in 2015 an outdoor lighting requirement report ’Ulkovalaistuksen tarveselvitys’, which outlines the objectives and principles of lighting in Helsinki.

Helsinki City has set energy-saving goals due to the EU energy services directive. According to the directive Finland must achieve a 9% improvement in energy efficiency by 2018. In addition, importing and selling new mercury and sodium-vapour lamps in the EU market was prohibited in 2015. Helsinki has developed a program to replace the traditionally used mercury and sodium-vapour lamps which are characteristic in urban lighting as a lighting source with new energy efficient lighting methods.

The use of land (maankäyttö) and the building regulation (rakennusasetus) and the city of Helsinki’s building ordinance (rakennusjärjestys) define mainly the lighting solutions permit requirements, compatibility of lighting fixtures and illumination levels with the cityscape, the actual design guidelines are lacking.

**General technical principles by Helsinki Public Works Department**

The goal is to have consistency in lighting and clear street hierarchy. The lighting, the light fixture type and the illumination level should support the functional classification of streets. The goals for the colour rendering index and colour temperature is set by the functionality of the area and the identity of the environment.

The Public Works Department has set guidelines for the colour temperature and the colour rendering index (CRI): In the downtown area of Helsinki the colour temperature is set to 3000 Kelvin and the colour rendering index to > 70, at the main and collector streets for cost control purposes it is possible to use light sources with CRI ≥ 60 and a colour temperature of 2500 Kelvin.

Helsinki Public Works Department has in general classified the illumination level category for the main streets in downtown area to M1+p1, M2+P2 or M3a+P3. The Illumination Level category is determined by the streets’ functional classification as well as the volume and speed of the traffic, and the existence of tram and bus stops.
The aim is to use cost-effective, energy efficient and recyclable light solutions suitable to the cityscape. Outdoor lighting solutions must fulfill safety standards, being vandal-resistant and the maintenance intervals must be as long as possible. Choosing a solution must take into account bus, tram stops and tram lines, the below ground structures, as well as the effect of shading and glare. The appearance of lighting fixtures can be decided case by case, unless the Helsinki City’s furnishing guidelines (kaupunkikalusteohje) has an existing instruction.

Outdoor lighting’s goal is to move towards a more energy-efficient light sources. The aim is to have a sufficient amount of light in accordance to the prevailing seasonal and traffic conditions.

Light from a single source must take into account other surrounding light sources for the purpose of forming a unified light distribution, minimising glare and other interfering light. Use of light distribution is determined by function of the area.

**Functional and cityscape goals for outdoor lighting**

According to 'Ulkovalaistuksen tarveselvitys' report from Helsinki Public Works Department, a large amount of light doesn’t automatically ease movement and navigation of users nor does it improve safety and the sense of safety. Lighting always requires good planning which takes into account the activity in the area, as well as the specific features of the cityscape. The users must be able to navigate and identify their position regardless of the magnitude of natural light. The city must have a clear outline of what is illuminated, how, and what objects are highlighted.

The general aim for the lighting development is to have a unified cityscape and to maintain a consistent level of quality. The design of lighting and the lighting fixtures should take into account the era, cultural and historical value, and the scale of urban space in the area. Lighting solutions must be based on a careful analysis of each areas district or location characteristics as well as the environment. The objective for lighting design should be the urban space as a whole, so that the main streets, squares and parks can be perceived with all of their specific functions, and not only as fairways to traverse.

Light fixtures are strongly creative elements of space. The height of the lamp-posts must be proportionate to the rest of the built environment. The number of lamp-posts should be minimized by utilizing joint usage with traffic lights and signs. Attaching lighting to the wall and the use of suspension cables for urban space illumination so that the lighting fixtures themselves are not highlighted is the preferred method for unificating the cityscape in a non-invasive way. The possibility of using suspension based lighting methods should be investigated whenever a street is bordered by buildings of sufficient height. The lighting fixtures’ colour scheme will follow the Helsinki City’s furnishing guidelines.
2.1.3 Current Situation Analysis

This analysis is a closer look at the site and its various elements illustrated with isometric diagrams and photos.

Because I had set up my objective for ‘Helsinki Central railway station and its surroundings’ new outdoor lighting plan’ to help facilitate the orientation of pedestrians, as well as improving safety in the area. It is vital to take into account the nature of the planning site and how it forms a multi-functional, architectural and historical entity that has one of the biggest challenges; the number of different modes of transport nodes and a large number of pedestrians.

Traffic and pedestrians’ movement in the site

For this analysis, I asked for the latest count of pedestrian and other traffic in the area from the Helsinki City’s Planning Department. As of writing this thesis, the latest data of the traffic count is from the year 2015, 11th of November and the latest data of pedestrian movements are from the end of October, 2014.

I got acquainted to ‘Helsinkiläisten liikkumistottumukset 2015’ report translated freely to ‘Helsinki City’s residents’ movement habits 2015’. The report was ordered by the City Planning Department and the report covered the years 2010, 2012, 2013, 2014 and 2015.

The report discovered that the inhabitants of Helsinki main modes of transportation in order are by foot, by public transportation, and by private motoring. The planning site is located in the downtown area and it echoes the rest of the city in the used modes of transportation by order. During the year of 2015 in the City of Helsinki, the most widely used forms of public transportation were by bus [16%), the metro [9%), the tram [6%], and by train [4%].

I did my own research of the area by observing the major trends of pedestrian movement at different times on several different occasions during the year 2015 and the beginning of the year 2016. From my own observations, the data from the City Planning Department and the data of ‘Helsinkiläisten liikkumistottumukset 2015’ report, I formed a ‘Traffic and Hot Spots Map’ for the site. The map illustrates all the transportation forms as well as the most important routes of the pedestrians and location of the ‘Hot spots’. Hot Spots in this context is meant as pivotal points in the area where different modes of transportation intersect.

I found out that the most traffic heavy spots are located close to the railway station’s main entrances, mainly for the reason that the station functions as a vital part of the major transport interchange in the city; commuter and long-distance trains, entries to the metro lines and two platform areas for internal and regional buses on both sides of the station.
Pedestrian traffic in the area [counted by hand]

Traffic load consisting of cars and trams in the area
Cyclist traffic in the area [counted by hand]

Kaivokatu is the most complicated and active street in the area; right in front of the station’s front entrance goes a bicycle route which is inadequately marked on the site. There are several street crossings and street lights. The street itself is heavy on traffic; buses as well as several tram lines, private motor traffic and taxi operators. The number of pedestrians in the location are great in number during the rush hours.

The station’s second most active entrance is on the West side. That entrance is very close to Eliel Square that functions as a platform for departures and arrivals for several bus lines. On the West side is also an entry to the internal and regional train platforms, taxies also have their own stop. Beneath Eliel Square is located a much used parking space.

In front of the East entrance of the station is located one of the “Hot Spots”; the Railway Square and one of the biggest platforms for departures and arrivals of buses in Helsinki. Most of the people have gathered right in front of the entrance on the ground level and further up on the stairs waiting for the buses.
Luminance \([\text{cd/m}^2]\) view from the top of Makkaratalo, March 9, 2015.
Luminance [cd/m²] measured at the site, January 25, 2016.
Luminance \( (\text{cd/m}^2) \) values in the site

Luminance is brightness of surface and its unit is \( \text{cd/m}^2 \). It may be measured from the light source, for example surface brightness, or the amount of light reflected by a surface. Luminance describes the impression of brightness created by different objects reflecting light. Luminance can be measured with a digital spot meter and in this case I used iPhotoLux Luminance Mapping System. The distance doesn’t impaire the measurement of luminance, though further away the surface area perceived will be reduced. Luminance levels are for example used to define glare.

In dry weather the luminance is ‘poor’ in the spots measured, but when the ground is wet or it is covered by snow or ice you’ll get the highest measurements in the terms of luminance values due to increased surface reflection. In Finland the road lighting regulations are based on European standard EN 13201\textsuperscript{26}. The site is classified as class M1 which means that the luminance level of the road surface should be the minimum value of 2cd/m\(^2\) \textsuperscript{8c}.

I measured the luminance values on two occasions; the weather conditions of the first measurement (March 9, 2015) were cold and the ground was dry. During the second measurement (January 25, 2016) the ground was covered in snow and slush. My measurements of the luminance values are indicative and are intended to only show the differences in different weather conditions at the time. Please notice that the scale varies inside the images attached (pages 43-45) from image to another, and the colour scale is true only within a single image. By my measurements of the site I can say that the luminance values are just enough to satisfy regulations but lacking in other areas.

Lighting fixtures in the area

On both sides of the Helsinki Central railway station’s main entrance are two pairs of statues called ‘Kivimiehet’ freely translated to ‘Stone men’, each man holding spherical lamps. The statues were renovated and restored in 2013 and the lamps are now illuminated by LED lights\textsuperscript{27}.

The main entrance and the West entrance used to have neon-light letters marking the entrances to the station. In 2015 the letters were changed to use LED technology instead\textsuperscript{28}. The light is cool white and the letters can be seen easily from a distance.

The East side and Kaivokatu are in general illuminated by high-pressure sodium lamps which are widely used for outdoor area lighting such as streetlights. High-pressure sodium lamps produce orange or ‘yellowish’ light, the lamps can be seen from the images attached (pages 50-52). High-pressure sodium lamps have poor colour rendering index (around 24 CRI) and have a tendency to drown out features and characteristics of the site with a ‘disturbing’ mono-coloured scheme. The reason for using high-pressure sodium lamps is due to good energy efficiency that still produces bright area lighting.
Helsinki Central railway station’s main entrances
Photographs taken in January 24, 2016.
Eliel square – West side
Railway Square – East side

Photographs taken in January 24, 2016.
Tram stops and other views
Photographs taken in January 24, 2016.
According to recent research the human night vision works better in the blue colour spectrum\textsuperscript{29}, high-pressure sodium lamps may not be as optimal solution as has been traditionally thought.

The West side of the station is illuminated by metal-halide lamps with a very good colour rendering index (85 CRI), the light produced is bright and white. Metal-halide lamps colour temperature is in 3000 or 4200 K. The use of metal-halide lamps in the site can be seen from the images attached (pages 48-49).

The metro entrances are illuminated by fluorescent lights which have a quite poor colour rendering index depending on the type of the lamps between 51 to 73 CRI. The entrances can be seen from the images attached (pages 48 & 52).

**Illuminance values (lx)**

A lux is equal to one lumen per square metre and a lumen is defined as the amount of light one candle produces per square meter to one meter distance. The lux (lx) is a unit of illuminance and luminous emittance, measuring luminous flux per unit area in the International System of units (SI). Sun light is at its brightest around 100 000 lux. In moonlight the amount of light is well below one lux. Light colour perception for humans becomes more difficult in less than 50 lux. Lux can be used to describe how good the lighting conditions are in the area. Typically the minimum amount of lux for outdoor general illumination is set to 30 lux.

I measured the lux values with an approved and calibrated measuring device ‘Konica Minolta’s CL-500 Illuminance Spectrophotometer’ on 10th of November 2015 after sundown. The measurements were done at different locations on the site and mostly straight under existing lighting fixtures when possible. The measurements showed that the amount of light in the site is in the most parts enough but there are also locations where the levels could be much higher in order to make the site more pleasant and more informative for the users. The measured values are displayed in the ‘Illuminance levels’ map, attached to page 55.

**Colour temperature (K) & Colour Rendering Index (CRI)**

Colour temperature refers to the light colour impression. Colour temperature’s unit is Kelvin (K). An incandescent light bulb is around 2800 K, warm coloured fluorescent lamp is around 2700-3000 K, white light is 4000 K, daylight is 5500 K and the blue sky is over 8000 K. Colour temperatures over 5000 K are known as cool colours (bluish white), while lower colour temperatures 2700-3000 K are known as warm colours [warm white].

Colour Rendering Index (CRI) describes the ability of the lamp to reproduce colour on the visible spectrum. The colour rendering index ranges from 0-100.
Where the value of 0 designates a completely monochromatic light, where
colours do not repeat at all, and at 100 a fully continuous spectrum of light.
A light which CRI is greater than 80 is usually perceived as quite natural. Less
than 70 CRI and the light is perceived as unnatural, or discoloured and some
objects’ colour may appear strange.

I measured the colour temperature and the colour rendering index at the
same locations and time with the same measuring device as I did with the
measurement of the illuminance values. I constructed a map of the measured
values, attached to page 56.

**Final conclusion**

I decided to put the ‘Illuminance levels’ and ‘Colour temperature & Colour
rendering index’ maps side by side on the same spread for better illustration
and comparison. From the map of the ‘Colour temperature & colour rendering
index’ it is easy to see the major differences between the West and East side of
the station also the poor illumination levels of Kaivokatu are clearly seen.

Most of the measured locations have enough light to satisfy regulations.
However, it is quite common that the colour rendering index is subpar. CRI
is under the recommended values for this kind of site and thus the area is
unpleasant for the users. This echoes the sentiment of the ‘User Experience
Survey’, the users expressed their need for a change in the atmosphere and
improvement of safety through lighting as well as helping their navigation and
movement in the area.

The results indicate that the lighting in the area emphasises the wrong things
and doesn’t help with navigation nor ease the movement. The amount of light
in most cases is enough but it could be distributed differently by different
lighting methods and emphasising objects in a better way: higher lighting
contrast between different objects and areas, cooler colour temperatures
and better colour rendering index inducing a more pleasant and effective
atmosphere for the benefit of the user.

The way the ‘letters’ and the spherical lamps held by the ‘Stone men’ in the
entrance to the station have been lit is in a method that is suitable for the
historical building and in accordance to it’s architectural characteristics, but
the lighting surrounding the area is in disharmony in relation to the station.
Eliel Square and the Station Square have more clarity and more pleasant
atmosphere when compared to some other locations in the area but they are
also lacking in amount of light at some locations. By unifying the lighting in the
planning site and also looking at the lighting beyond the technical standards of
illuminance levels and city guidelines we can achieve a pleasant and consistent
cityscape, clarity of movement and increased safety in the site.
2.1.4 Constraints & Opportunities

The site has a series of exciting challenges. The site forms a focal point at the heart of a district which has been neglected in the past decades and only recently city officials have decide to develope the area. A range of major urban and transport projects like the metro development\textsuperscript{50}, Kruunuvuorenranta\textsuperscript{18}, Kalasatama\textsuperscript{31} and the Middle-Pasila\textsuperscript{32} have brought new momentum to the city planning in Helsinki. There is therefore a unique opportunity to transform this neglected site into a new public space.

The City of Helsinki and its centre are developing fast; On Kivokatu are planned stops for ‘pikaratikka’ freely translated as ‘fast trams’. The plan will come to fruition around the mid-2020’s\textsuperscript{33}. There is also a plan for the development of a ‘Piisaratara’ freely translated as ‘the drop line’. Piisaratara would act as a city rail link meant for commuter trains. A teardrop-shaped rail line would start from Pasila and circulate in a tunnel through Töölö, under the city center and Hakaniemi back to Pasila. The final decision for construction has not yet been made\textsuperscript{34}.

Various parties operate in the area; City of Helsinki’s Public Works Department and the City Planning Department, VR Group, real estate owners, National Board of Antiquities, The Finnish National Gallery, Helsinki City Transport (HKL), Helsinki Region Transport (HSL) and The Finnish National Theatre. To create a workable lighting design plan that will please all the parties involved may prove to be challenging.

The biggest challenges are in the different modes of transportation and safety. The site is large in scale and has various elements serving different user segments. The new design plan has to work within the framework of city regulations. New lighting fixtures need to be environmentally friendly and energy-efficient. City of Helsinki is located in far North (60°10’15”N 024°56’15”E) and the period of darkness is very long, but during the summertime there is lots of sunlight. The weather during the winter months can be very snowy and icy thus the lighting fixtures have to be able to withstand and unobstructed in different weather conditions and seasonal changes.

It’s necessary to keep in mind the objective for the new lighting design plan to maintain a framework that will ensure a viable execution. The plan has to take into consideration the multitude of different user needs and to keep the focus balanced and harmonious without falling into the pitfall of favoring one segment over the other. New lighting technology brings lot of novel opportunities in the lighting design field offering more freedom to a designer. Overall the constraints of the site bring forth positive challenges, thriving the designing process to a better end result.
2.2 Development Plan

2.2.1 Development Process

Architectural lighting design is a necessary part of planning our visual environment. It’s an integral part of the field in architecture, spatial design and architectural engineering which serve our day to day needs.

The design process of architectural lighting takes into account what kind of human activity is in the area, the amount of light that is required, the colour temperature of the light, the distribution of light and the effect of light to the environment. For a lighting designer, it’s important to understand what kind of response the lighting has to its users, therefore the human perception must be a key consideration in the design process.

Architectural lighting design aims to create conditions where it’s possible to work effectively, easy to perceive space, orient and navigate safely and at the same time to feel comfortable in that environment without forgetting to enhance the aesthetics of that particular environment.

In the design process of architectural lighting there are three fundamental aspects in illumination of spaces and buildings:

**Functionality**
The role of lighting is measured by it’s effect on the function of the area. The focus is on the visibility, glare and distribution, colour confusion and safety issues.

**Aesthetic appeal**
The focus is on raising the overall attractiveness of the area, buildings and their surroundings which can be reached in many ways; should something be delicately blended into background or should it stand out, without forgetting what kind of emotions the lighting evokes.

**Energy efficiency**
Good lighting design ensures that light won’t be wasted by general over-illumination or unnecessarily providing more light than is needed for aesthetic reasons or for the task itself.

Good and efficient architectural lighting design is relative to the scale, accentuating objects and functions in a priority based hierarchy. Movement within the parameters set by the general illumination, smaller objects will gradually emerge in the space enabling a more detailed design. Architectural lighting design has achieved its aims when it emphasises the architectural features and aesthetics and it’s an efficient, functional and cost effective part of the area.
2.2.2 The Design Elements

A closer look at some details of certain elements in the lighting design plan. Some of the design elements are from City of Helsinki’s city centre plans and are considered as priorities for the new lighting plan.

Kaivokatu
The current ‘highway lighting’ will be changed to a more suitable lighting for pedestrian environment. With smaller scale lighting and lighting fixtures it is intended to signal motorist that they are operating in a very busy pedestrian environment. The focus will be especially in the pedestrian crossings to the station, bus terminals, tram stops, and pedestrian streets and squares. The cycle path will be highlighted and made more visible to the users and other traffic.

The Railway Square
The new lighting highlights the square as a unified space. The new lighting emphasises the square functions as a pedestrian precinct and an event area as well as a bus terminal. The lighting in the Eastern part of the square aims to increase safety and help to ease the movement of the users at the Mikonkatu intersection. The lighting plan will also takes into account the new lighting at Keskuskatu, the Ateneum–National Theatre axis and the statue of Aleksis Kivi will be highlighted. The lighting in the square area is planned to work with the reflecting light from the surrounding buildings.

Helsinki Central railway station
The railway station is functionally the most significant hub in the city centre. The plan will pacify the area with soft lighting for the users and bring forth the outstanding architecture of the historically integral building. The station’s clock tower will be further highlighted and adjusted to the surrounding lighting. The lighting for the main entrances to the station will be planned with the ease of navigation of the commuters in mind.

Station Square & Elieel Square
The squares lighting will be renewed to be part of the station’s lighting entity. The lighting aims to highlight both squares as a unified space with consideration given to their specific functions as a pedestrian and bus terminal space. Lighting is also designed to take into account their role as a pedestrian access points to the downtown, the train platforms, Kamppi and from Postitalo to the Töölö Bay.

Other relevant elements
The pictorial highlights of the cityscape: architecturally, culturally and historically valuable buildings, their details, trees and sculptures. Lighting, colour rendering index and lighting fixtures should be of a high standard and the right scale for the environment. The facades of other buildings in the planning area are brought forth with proper illumination complimenting the surrounding space and the overall lighting style.
3

THE ARCHITECTURE LIGHTING DESIGN
3.1 Framework for the Design

Lighting design does not simply mean just choosing the right lighting fixtures to the given space, it’s more about the light itself and the right lighting methods to achieve the goals for the desired lighting. The lighting designer’s work is about finding out what those goals are for the given space and to create the lighting concept as well as executing it. In the book ‘Architectural Lighting – Designing with light and Space’ Hervé Descottes writes about the lighting designer’s work:

“A lighting designer is generally responsible for providing both the conceptual approach to the lighting of a given space as well as the technical analysis necessary for its successful execution.”

The planning process begins with the lighting design concept. After the approval of the concept from the client and the appropriate authorities, the process moves on to the next phase of creating the execution plan. The second phase shows in detail how the illumination would function within the space through visual illustration, a proof of concept. The third phase consists of laying out the technical plan which defines the installation works and technical details. The planning process comes to completion with the final implementation.

Lighting technology is evolving at a rapid rate and therefore it is vital for a designer to keep up with the latest developments within the field. It is not at all unusual for the technical plan to be outdated by the time it is finished as there may already be new more efficient and better ways to execute the plan. It is more than vital to do the lighting tests on the site before executing the final lighting plan. The aim with a lighting test is to demonstrate on site ‘The Lighting Design Plan’s’ lighting methods feasibility in practise. The lighting test should discover and ensure the right lighting principles and methods, test the planned lighting fixtures in practise and make sure that the lighting levels are correct for the site.

For the reasons listed above I am only focusing on the lighting design concept and the light itself for the site and not going deeper with choosing the right lighting fixtures or making a more defined plan.
Map of light and darkness

Street lighting will provide the basis for building the functional lighting in the area, mainly consisting of pole and pendant lights. The bollard lights are used along pathways, at the edges of the squares working as boundary markers and applied as small scale area lights. The bollard lights are kept below eye level with an exception of a few area lighting applications, keeping visual distortion in the surrounding environment at low levels. Linear lighting is used for user guidance and highlighting critical areas with heavy traffic for different users segments thus increasing safety in the area; at Kaivokatu in front of the station, at the pedestrian crossings and on the cyclists paths. The facades and entrances are enhanced with spotlights and linear lights which are recessed where possible. The facades lighting’s idea is to evoke a pleasant aesthetic atmosphere for the users by complimenting the texture and form of the buildings.
3.1.2 The Lighting Colour Temperatures

The majority of the area is covered by a warm white light (3000-3500 Kelvins). The colour temperature will shift gradually from warm light (3000 K) to a neutral white (4000 K) in the areas of Elie Square and The Railway Station Square. Neutral white light is also used to mark and highlight the main entrances.

Colour rendering index is greater than 80 and reproduces natural colours.
Several different lighting methods are applied in order to get the desired effect for atmosphere, feel and functionality. Illumination of objects are in the main role, luminaires and the technology are recessed where possible in order to minimise unnecessary architectural disturbance.

This conceptual plan does not represent the accurate placement and shape of the lighting fixtures.
Lighting Method Symbols

A  POLE AREA LIGHT
B  POLE FACADE & AREA LIGHT
C  PENDANT LIGHT
D  BOLLARD DOWNLIGHT
E  BOLLARD FACADE LIGHT
F  DOWNLIGHT FROM BUILDING
G  RECESSED FACADE LIGHT
H  INTERNALLY LUMINOUS ELEMENT
I  WALL/FACADE UPLIGHT
J  RECESSED GROUND UPLIGHT
K  RECESSED GROUND DIRECTED UPLIGHT
L  WALLWASHER
M  RAILING LIGHT
N  LINEAR LIGHT
O  FAN LIGHT
P  GOBO LIGHT
3.2 Helsinki Central railway station & surroundings – Visualisations

Front side of Helsinki Central railway station

The Helsinki Central railway station’s main entrance’s arched window is highlighted by a fan light casting a 180° arch of light. The arch itself is illuminated with several smaller spotlights used as accent lights in order to enhance the details. Underneath the visor roof attached to the ceiling, a soft linear light is used for general lighting purposes and warm coloured downlights for highlighting pathways in to the station. The spherical lamps hold by the iconic ‘Stone Men’, the letters, and the clock tower’s clock-face are internally luminous elements glowing cool white light.
The station’s walls are ‘wall washed’ with spotlights attached to the building’s eaves and with lighting poles and bollards, or in the ground of planting areas. The light beams of the spotlights are around 15 degrees wide. The Metro station entrances located right next to the main entrance are illuminated by a soft linear light. A bicycle pathway passing the main entrance is illuminated using gobo lights or by recessed and angled linear light. The same techniques are used for the pedestrian crossings. The station’s front area is separated from Kaivokatu with a linear handrail light in order to give a more defined look for the area.
East side of Helsinki Central railway station and the Railway Square
Daylight view & the lighting methods

The bicycle pathway going around the Railway Square and passing by the main entrance is illuminated with gobo lights [P] or by recessed and angled linear lights. The same lighting techniques are used for the pedestrian crossings and the same style is used for the whole of the planning area. The tram and bus stops are highlighted by soft linear lights [N] and ‘washed’ with general area light [A]. Aleksis Kivi’s statue located in the end of the Railway Square is illuminated with a narrow beam spotlight, attached to an area lighting pole. The plantings around the statue are illuminated using the same pole and with a recessed ground directed uplight [K], this technique is also used for all the trees in the area. The Railway Square is illuminated by area
lights with subtle soft lighting. At Mikonkatu downlight bollards [D] are used to mark the sides of the tramline tracks. The Station’s East facade is ‘wall washed’ with spotlights [L] attached to the building’s eaves and to lighting poles and bollards, or from the ground of planting areas. The architectural details will be highlighted with several smaller spotlights. The several historical buildings in the area will be illuminated with the same lighting design style as the Railway Station, a warm white light bringing cohesion to the area suitable for the historical and architectural era of the buildings. The ‘opening views’ are mainly illuminated with neutral coloured white pendant lights [C].
West side of Helsinki Central railway station and the Station Square
Original photograph has been taken from the rooftop of Postit&auml;o in March 11, 2015.
Kaivokatu

Kaivokatu is one of the busiest streets in the city of Helsinki and it has several pedestrian crossings and multiple different modes of traffic. With proper lighting techniques paying special attention to the crossings and delineating the movement between the traffic and the pedestrians will bring a clear hierarchy to the site. By using gobo lights [P] or recessed and angled linear lights [N] for the crossings the lighting will provide an even and well controlled luminance [cd/m²]. Linear lighting is used to separate and highlight the tram stops. In the new lighting design the bicycle pathway stands out from the rest of the traffic and won’t be as easy to confuse as a pedestrian pathway.
Original photograph has been taken from the VR Clock tower in March 20, 2015.
3.2.1 Mobility & Circulation

For areas with multiple different modes of traffic and lots of interaction with business, residential and public buildings it is vital to create stable circumstances where mobility and circulation of people will be functional without any distractions. A way to ease the mobility and circulation on the site is to bring the lighting to a more human scale level and highlight the main entrances. Implementing an increased efficiency of mobility by the use of recessed linear light in existing railing in the area. Marking the pedestrian crossings and bicycle pathways with soft even light thus highlighting them for motor traffic will increase overall safety and visibility in high traffic areas.

Tram stops on Kaivokatu and metro station entrances

For areas with multiple different modes of traffic and lots of interaction with business, residential and public buildings it is vital to create stable circumstances where mobility and circulation of people will be functional without any distractions. A way to ease the mobility and circulation on the site is to bring the lighting to a more human scale level and highlight the main entrances. Implementing an increased efficiency of mobility by the use of recessed linear light in existing railing in the area. Marking the pedestrian crossings and bicycle pathways with soft even light thus highlighting them for motor traffic will increase overall safety and visibility in high traffic areas.
Eliel Square

The routes to the entrances of the metro, the train platforms as well as to bus and tram stops are more visible and easier to perceive. A clear view from point A to B has a huge impact on the experience of space itself. In the new design plan the lighting is scaled to a more human level; in order to create more appealing and less bare environment for the users which will enhance the feeling of safety and improve visual orientation. The lighting design’s pedestrian centric approach will make the hierarchy clearer and serve the users more efficiently, the motorists are better able to perceive the overall action of cyclists and pedestrians in the area.
Kaivokatu and bus stops on the Eastern corner of the railway station
All the original photographs on this spread have been taken from the VR Clock tower in March 20, 2015.

Bus stops on Railway Station Square and pedestrian crossings on Kaivokatu
3.2.2 Open Spaces

The planning area consists of three squares; the Railway Square, Eliel Square, the Station Square. The immediate surroundings of the main entrances to the station and metro. The pedestrian crossings and the bus stations on the Western and Eastern sides of the railway station.

The basis for open space’s lighting design is in the need for general lighting as well as to create a pleasant environment for the users. Eliel Square’s general lighting is mainly attached to the poles, illuminating the surrounding areas and some of the facades. The bus stops in Eliel Square are illuminated by linear lighting attached to the canopy. The recessed ground directed uplights [K] illuminate the trees and give a soft light for ambiance. The station’s walls are ‘wall washed’ with spotlights giving a sense of sufficient illumination in the whole area for the users. The Station square is illuminated with lighting poles [A & B] and some of the lighting for the square is emitted from the station’s Western entrance’s illumination.

The need for general lighting in the Railway Square’s is smaller than in other areas. The Railway Square functions at times as a venue for various events so the middle section of it has to be kept open. The square has a small number of lighting poles illuminating the area. The edges of the square are planted with trees which are illuminated with the same technique as are all the trees in the whole planning area giving a soft light for general ambiance.

The bus station situated right next to the Railway Square is illuminated from the poles. The bus stop weather shelters have linear lighting attached to their ceilings. Across the bus station runs one of the biggest pedestrian crossings in the area, illuminated mainly with gobo lights [P] which are attached to the same lighting poles used for general area lighting and with angled linear lights. The immediate surroundings for the railway station entrances are illuminated from the poles as well as with the light emitted from the illumination scattering of the entrances. The parking lots located in front of the station’s main entrance are illuminated by the general area lighting fixtures.

Overall the lighting design for the open spaces is very smooth and consistent, supporting the surrounding areas and the exterior side of the railway station. The focus point is to support all the functions in the area and not to shower ‘empty space’ with too much light.
3.2.3 Safety Experience

We are dependent on artificial lighting for our modern urban needs. There exists a quantifiable need to control the limiting effect of darkness by illumination of space. The amount of light has a concrete effect on safety and perception of objects within a space, therefore it is important to utilise proper light usage giving a sense of control to the user. Showering a space with artificial light won’t have the desired effect for the end user, it will be counter-productive for the goals of proper guidance, glare reduction, safety and the imitation of a natural light atmosphere.

Quality of lighting is measured by the colour rendering index (CRI), colour temperature and proper use of light projection in a given space. With colour rendering index of (CRI > 80) human perception will work more efficiently in dimmer lighting conditions. Use of colour temperature in the spectrum of neutral white colour in contrast to warmer colours we achieve the same enhanced perception of space for the human eye. This needs to be carefully balanced as having a ‘too cool’ colour temperature will cast an unpleasant and cold light detracting from the atmosphere of the environment. A bit of warmth in the light has a positive comforting effect on the user.

In the new lighting design plan, the lighting has been set to a lower height and the area has not been washed with excessive light, the architectural details have been highlighted and the routes are now more visible. The quality of light is well-balanced on both sides of the station, the colour temperature and CRI are unified in the area. Perception of space is more efficient and recognition of the elements in the area is easier for the user. The experience of space is coupled with the sense of safety, improving the former will elevate the latter.
3.3 Effect and interaction with business, culture, residential, civic and public form and function

In a modern city, illuminated building facades and advertising are a normality. Imagery of neon coloured city centre’s and flashing lights have deeply rooted themselves in to our collective minds. Almost everything that shines from the windows and walls is light in the form of advertising. In some of the European cities illuminated ads are subject to the cities’ planning approval and under tight regulation, and in some cities like the City of Vancouver street advertising is outright banned apart from store windows. I predict that a more strict control to light pollution in the form of advertising will be common throughout the world in less than a decade. There has been a lot of research in how light pollution has a negative effect to human and other animal behaviour and with more focus on solving the impending climate change unnecessary lighting is also going out of vogue.

In the new lighting design plan I haven't focused much on the existence of advertising. I'm not offering a solution for how the business buildings should be lit but I recommend less ads and better quality of light. Better quality of light and a more unified look in the area will serve the users better and give a more positive effect and interaction between business, culture, residential, civic, and public form and function. The new lighting design will bring out the best qualities of the area by making the routes more visible from point A to B, increasing safety and bringing balance and clarity to the area attracting and serving all parties.

The new lighting plan improves the atmosphere making it more inviting and pleasant, with an aim to increase time spent in the area thus raising potential customer numbers for on site operators. Decreasing the light pollution will simplify navigation, raising user awareness and benefiting all operators in the area instead of being drowned out by excessive overload of information.

With focus in a more complementary illumination for the station's facades, avoiding dramatic shadows and over illumination will have a positive impact on the whole impression of the City of Helsinki in an international level.
“We find beauty not in the thing itself, but in the patterns of shadows, the light and the darkness, that one thing against another creates.”

– Jun'ichirō Tanizaki
5

APPENDICES
5.1 Glossary

**Accent lighting**
Focuses light on a particular area or an object. It is often used for highlighting.

**Ambient lighting**
Provides general illumination throughout an area. Offers comfortable level of brightness without glare.

**Bollard**
Short vertical post, used for path and area lighting.

**Candela (cd)**
The SI unit of luminous intensity.

**Colour rendering index (CRI)**
Ability of a light source to display colours, expressed as a numerical value between 0-100. Higher value indicates a more natural colour reproduction.

**Colour temperature (K)**
The colour impression of light. The colour temperature’s unit is kelvin. Values below 3500 K are described as warm colours, 4000 K is neutral white and values above that are considered to be as cool colours.

**Contrast**
Relationship between the illuminated object and its background.

**Diffusion of light**
Scattering or softening of light.

**Direct lighting**
Light sources that distribute most of the light towards the surface, typically downwards.

**Downlight**
Beam of light directed downwards. A downlight is quite often recessed.

**Fan light**
A light source casting a 180° arch of light.

**Fluorescent lamp**
Low pressure mercury-vapor gas-discharge lamp that uses fluorescence to produce visible light.
Glare
A very harsh, overly bright, dazzling light. Causes discomfort, or loss of visual performance. Can be caused by a wrongly directed light or light reflecting from a glossy or pale surface. A too strong contrast between light and darkness.

Gobo light
Light source that has a stencil or a template in front of the projection for creating patterns and shapes.

Hard light
Illumination that is sharp edged and high contrasted.

Railing light
Illuminated railing or handrail system.

High pressure sodium
A lamp of high energy efficiency but low CRI. Used a lot for street lighting.

Illuminance
Amount of luminous flux per unit area.

Indirect lighting
A concealed light source used for casting a reflected light to a desired surface.

Kelvin
Unit of the colour temperature; describes the scale of colour temperature.

LED
Light-emitting diode; a two-lead semiconductor light source.

Visible light
Electromagnetic radiation visible to the human eye. Wave length between 380-780 nm.

Lighting categories
The City of Helsinki’s lighting categories for street illumination: M1+P1, M2+P2, M3a+P3.

Lighting norms
See pg 89, 5.2 Charts.

Linear light
Provides symmetrically distributed lighting without any visible hot spots. Usually a 120 degree beam of light.

Luminaire
Complete lighting unit or fixture.
Luminous flux
Amount of light coming from a light source. The unit is lumen [lm].

Luminance
Describes the brightness of the examined surface. The unit is defined as candela per square metre [cd/m²].

Lumen [lm]
The unit of luminous flux.

Lux
One lux is equal to one lumen per square metre: 1 lx = 1 lm/m² = 1 cd x sr/m²

Pole light
Tall vertical post used for a facade, path and area lighting.

Soft light
Illumination that has soft edges and casts faint shadows.

Spotlight
Provides an optimal narrow or wide beam of light. Can also be used as a wallwasher.

Uplight
Beam of light is directed upwards.

Wallwasher
A luminaire used for illuminating facades.
5.2 Charts

Lighting Norms

The City of Helsinki has set parameters for the colour temperature and colour rendering index by area:

<table>
<thead>
<tr>
<th>AREA</th>
<th>COLOUR TEMPERATURE (K)</th>
<th>COLOUR RENDERING INDEX (CRI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City centre</td>
<td>3000 K</td>
<td>&gt;70</td>
</tr>
<tr>
<td>Business District</td>
<td>2800-3500 K</td>
<td>≥60</td>
</tr>
<tr>
<td>Parks</td>
<td>3000 K</td>
<td>&gt;70</td>
</tr>
<tr>
<td>Beaches</td>
<td>2800-3500 K</td>
<td>≥60</td>
</tr>
<tr>
<td>Residential</td>
<td>2800-3500 K</td>
<td>≥60</td>
</tr>
</tbody>
</table>

For cost reduction it is possible to use light sources in the main and side streets with values of CRI ≤ 60 and a colour temperature of 2500 K.


Lighting Categories

The City Of Helsinki defines luminance values by M-category for street lighting:

<table>
<thead>
<tr>
<th>Category</th>
<th>Dry and wet tarmac luminance</th>
<th>Anti-glare</th>
<th>Peripheral illumination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DRY</td>
<td>WET</td>
<td>DRY</td>
</tr>
<tr>
<td></td>
<td>$I_L$ cd/m², min</td>
<td>$U_I$ min</td>
<td>$U_L$ min</td>
</tr>
<tr>
<td>M1 [AL 1]</td>
<td>2.00</td>
<td>0.40</td>
<td>0.60</td>
</tr>
<tr>
<td>M2 [AL 2]</td>
<td>1.50</td>
<td>0.40</td>
<td>0.60</td>
</tr>
<tr>
<td>M3a [AL 3]</td>
<td>1.00</td>
<td>0.40</td>
<td>0.60</td>
</tr>
<tr>
<td>M3b [AL 4a]</td>
<td>1.00</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>M4 [AL 4b]</td>
<td>0.75</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>M5 [AL 5]</td>
<td>0.50</td>
<td>0.35</td>
<td>0.40</td>
</tr>
<tr>
<td>M6</td>
<td>0.30</td>
<td>0.35</td>
<td>0.35</td>
</tr>
</tbody>
</table>

M-categories updated to the standard SFS-EN 13201-2. Notations in brackets will be phased out.

Pedestrian and bicycle lane categories updated to the standard SFS-EN 13201-2. Notations in brackets will be phased out.


<table>
<thead>
<tr>
<th>Category</th>
<th>Horizontal illuminance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$E_{m}^{1)}$ [lx, min]</td>
<td>$E$   [lx, min]</td>
</tr>
<tr>
<td>P1 (K1)</td>
<td>15,0</td>
<td>3,00</td>
</tr>
<tr>
<td>P2 (K2)</td>
<td>10,0</td>
<td>2,00</td>
</tr>
<tr>
<td>P3 (K3)</td>
<td>7,50</td>
<td>1,50</td>
</tr>
<tr>
<td>P4 (K4)</td>
<td>5,00</td>
<td>1,00</td>
</tr>
<tr>
<td>P5 (K5)</td>
<td>3,00</td>
<td>0,60</td>
</tr>
<tr>
<td>P6 (K6)</td>
<td>2,00</td>
<td>0,40</td>
</tr>
</tbody>
</table>

1) For sufficient levels of even lighting the average value in a project by basis must not exceed the average minimum value of a category by x1,5.
5.3 References


