



DEMAND ANALYSIS

Pilot areas in Town of Sušice

Version 1
02 2017

The demand analysis focuses on the user's demand for lighting according to their social needs in Town of Sušice in two different pilot areas in Czech Republic.

Demand analyse aims to find out to which extend users accept energy efficient dynamic lighting applications & what needs to be adapted to increase acceptance.

The following pilot area has been selected as part of the "Demand analysis" task.

- Pilot Area - Park „Santos“, Town of Sušice, Czech Republic.

The demand analysis for dynamic public lighting is conducted in accordance to the following structure.

1) Area functionality

- Analysis of the environment and layout, zoning

2) Stakeholder analysis

- Identification of key stakeholders
 - Description of their basic attitudes and requirements
- Analysis of final users
 - Number of users
 - Time of use, frequency, goals
 - Activities as a function of time
- Analysis of expectations and needs of final users
 - lighting requirements of different users
 - lighting requirements changes during the day
- Overall stakeholder requirements

3) Built Environment/ Urban Fabric, Access and circulation

- Analysis of changing lighting requirements in space
 - Street, walkway and pedestrian zone geometry
 - Prominent open spaces, Primary traffic routes
 - Pedestrian routes- Resident movement, office workers, recreational, tourists etc.



- Understanding prominent landmarks, features and space determining public lighting
 - Developing dynamic lighting recommendations to meet requirements and demand
 - Type of light sources, luminaires, sensors and etc.
- 4) Lighting analysis and conditions survey
- Analysis of the existing lighting conditions
 - Type of light sources, luminaires, sensors and etc.
 - Evaluation of key indicators to track the benefits of dynamic public lighting
 - Comparing the before and after

As a source of information the quantitative and qualitative analysis of the data obtained from the field survey and the analysis of secondary municipality reports on situation of traffic and park's utilization survey is used.

- 1) Field survey
 - Analysis of park utilization by stakeholders
 - Activities, uses and functions
- 2) Municipality reports (public lighting master plan, Town strategies and etc.)
 - Existing lighting conditions,
 - Lighting requirements.
- 3) The questionnaire survey has shape as of "interview" on base of questionnaire within stakeholders. Together, 25 questionnaires were carried out.
- The questionnaire survey consists of following parts related to the core demand analyses questions:
 - If, how, in what form and to what extent stakeholders use the park.
 - What are the public lighting expectations and needs of final users?

1. Park „Santos“, Town of Sušice, Czech Republic

Park „Santos“ is located near to the city centre by the riverside. Totally, 36 poles are placed in two supply sides (see red and red/blue lines).

GPS: 49° 13'34.6"N 13° 30'57.4"E



Fig. 1, Park Santos, supply side, Town of Sušice

1.1. Area functionality

Urban forest park was founded on the island of Santos before the first World War and during the First Republic became the centre of social life in Sušice. After the war, it began to deteriorate due to the lack of maintenance but remained a popular place for recreation. In 2013, it was renovated and is now a popular place of relaxation and leisure activities. Also it acts as a link between two parts of the city and the historic centre for pedestrians and cyclists. It is therefore important link in the city.

1.1.1. Analysis of the built environment and layout, zoning

The area consists of several buildings (grounds) built during pervious century (mainly in latest 5 decades) and within the park form entertainment complex for sport and leisure time. The public swimming pool, athletic stadium, indoor stadium, tennis courts, hotel and restaurant are located in this area.

The defined area has been surveyed to arrive at an overview of the current situation. Fig.2 depicts a basic land use pattern and zoning of the site. As it can be observed this area is predominantly recreational with sparse sports fields.

Activities, uses and functions (importance, 1 up to 5, 1 for less)

		Park „Santos“	Off park (playground)	Driveways
Walking	Spaces used mainly for pedestrian movement. Pedestrian areas, transit areas etc.	5	5	3
Staying	Spaces meant for long stay, like tourist spots, shopping areas	2	2	2
Meeting	Spaces used for social interaction like city squares etc	5	4	2
Driving	Spaces/roads used mainly by traffic	1	1	4



Playing/ fun	Spaces for activities like casual sports, jogging, get together etc.	5	5	2
Cycling:	Spaces designed for cycling.	5	3	4
Safe movement:	Spaces requiring extra safety and security.	3	5	3

Identified core public lighting zones (Park “Santos” and “Driveways”) have different requirements for dynamic lighting. Park “Santos” zone is less used and requires more “warm” light as well as the design must be oriented on security. Driveways should be lighted more constantly, more traffic oriented.

Land use of the locality and zoning of public lighting:

- Park “Santos”
 - o White roads which are used only by pedestrians and cyclists during the day and at evening.
 - o The area is predominantly “chill-out” zone for sports and walking.
 - o It works as coupling roads connecting two parts of the town within town historical centre (only for pedestrians or cyclists).
 - o Sub-zone 1
 - Trouble-spot (see red sketch) - flock of youngsters during the night making noise and vandalism
 - Problem with public lighting which is located in distance from the road (see black line)
 - o Sub-zone 2
 - Summer restaurant and disco - Flock of people during the summer, insufficient lighting.
 - o Sub-zone 3 (Off park)
 - Playground and restaurant - insufficient lighting.
- Driveways
 - o Purple roads which are used by pedestrians or cars and ensuring access to the locality.
 - o Sub-driveway 1
 - Yellow marked roads with no public lighting. Possible construction of new public lighting.

When considering the lighting demand of an area, the use of the sports complexes and surroundings in the hours of darkness provide essential information. The time zone of 16:00 hours to 06:00 hours is used as the longest requirement for artificial lighting.



Fig. 2, Park Santos, Analysis of the Built Environment and layout, Town of Sušice



2. Stakeholder analysis

This section carefully analyses the different stakeholders and users in the study area and their specific demands and needs to ensure the fulfilment of the requirements of all the users. It identifies which stakeholders are dominant or which stakeholder demands are important. Through the integration of stakeholders into the lighting plan, the lighting plan can respond to the context and users of the space.

The identification of problems, needs, expectations and desires from public lighting of the different stakeholder is identified by using the following methods:

- Questionnaires aimed at the users
 - o Investigations into the level of awareness, knowledge and acceptance of dynamic lighting control systems for public lighting.
 - o Investigations into the site specific problems, needs and expectations of the different users at the specific pilot site.
- Questionnaire aimed at the municipalities - Investigations into the level of awareness, knowledge and acceptance of dynamic lighting control systems for public lighting applications.
- Field observations to investigate the use of the part during the year (Number of users, Time of use, frequency, Activities as a function of time).
 - o Conducted during the Spring 2017. Totally 7 tracked days, 4 working days, saturday and sunday.

The designed questions, in both questionnaires, were measurable and comparable. For that reason, the questions have a yes/no form or very short open questions. The controlled interviews were used to filling up the questionnaire to ensure proper fulfilment of all relevant questions/information.

Totally, 29 questionnaires have been collected (two from municipal representatives, two from restaurants and 25 from general public attending park Santos). All the data were taken during spring, 2017 in the Santos park, Town of Sušice.

General public

Males:	16 (64%)
Females:	9 (36%)
Age:	
0-14	1 (males 1, females 0), 4%
15-64	23 (males 14, females 9), 92%
65+	1 (males 1, females 0), 4%

2.1.1. Identification of key stakeholders

The survey of Town of Sušice identifies the following key stakeholders and their specific problems and interests; Town of Sušice, 1.2.1.3. Nadace Proměny Karla Komárka, Restaurants and General public.

2.1.1.1. Town of Sušice

Town of Sušice is the owner of public lighting as well as the operator throughout its 100% owned and funded organization SULES (Sušické lesy a služby, s.r.o.).



From the general point of view, Town of Sušice has remarkable interest in dynamic public lighting utilisation but raising from conducted survey, municipal representatives mentioned several core points which are stressed in form of short SWOT analysis below.

Among the remarkable strengths belongs the municipal interest in future implementation backing with high energy saving potential and improving feeling of security and safety at night, up. On the other hand, core general weaknesses are a decision-making process (political), investment costs and lack of awareness of local politicians and general public. Leading opportunity in Town of Sušice (as well as in Czech Republic as a whole) are seen government incentives for implementation of dynamic lighting; as main threat is taken into consideration the economic demands of the investments into dynamic public lighting avoiding municipal representatives to do so.

The Town of Sušice is already aware of dynamic lighting control strategies as well as is aware of the advantages offered by a dynamic lighting control system for public lighting. Overall, municipal representatives have enough information and knowledge about dynamic public lighting.

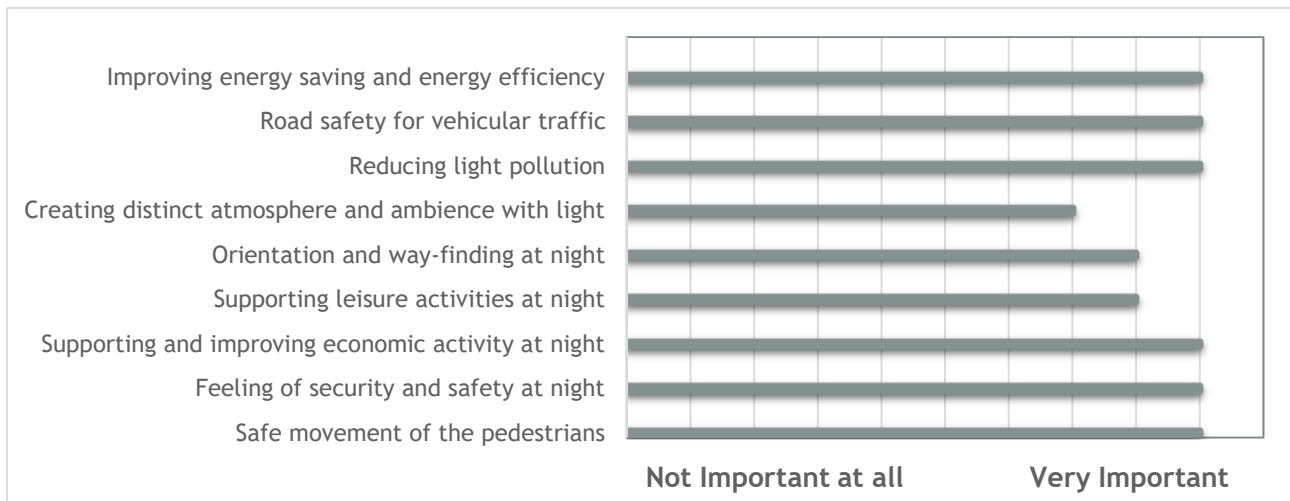


Fig. 3, Town of Sušice, Function of the public lighting

The Table above shows main aims and function of public lighting in the study area as they were identified by municipal representatives. Among the most important function of the public lighting belong road safety, reducing light pollution, security and safe movement of the pedestrians and supporting and improving economic activities at night. On the other hand, less important function is seen in creating distinct atmosphere and supporting leisure activities at night.

The expectations of the town representatives from lighting control strategies are visualised in chart below. As the main expectation is mentioned improvement of energy efficiency. Among less important expectation belongs aesthetic design of the study area.

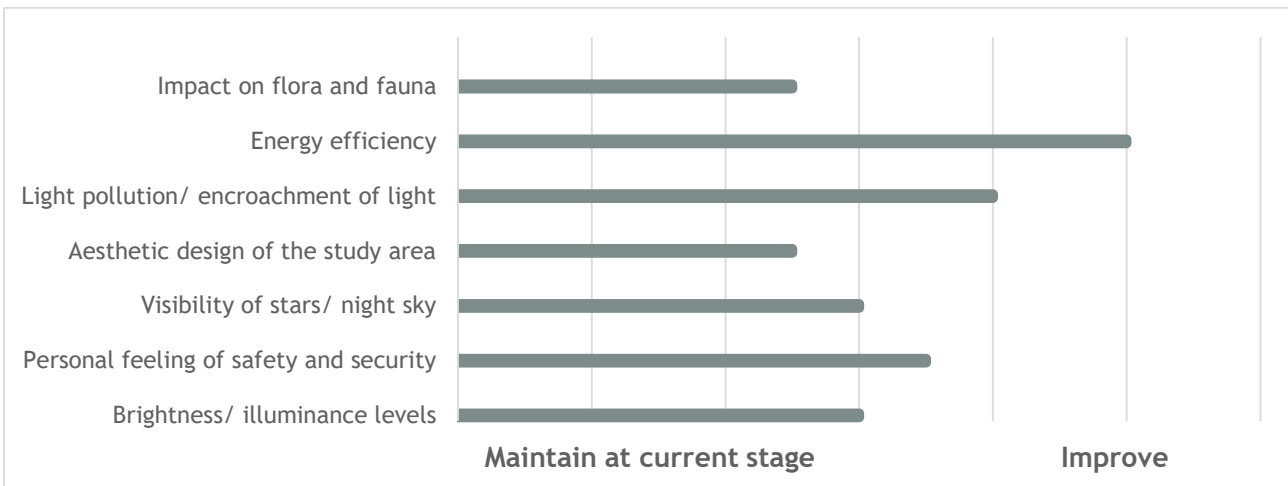


Fig. 4, Town of Sušice, The expectations of the town representatives

2.1.1.2. Restaurants

In the park Santos and surroundings, two restaurants are located there. Both are close-knit with playground and related leisure activities. At both locations, the level of public lighting is rather poor and it is wise to be improved.

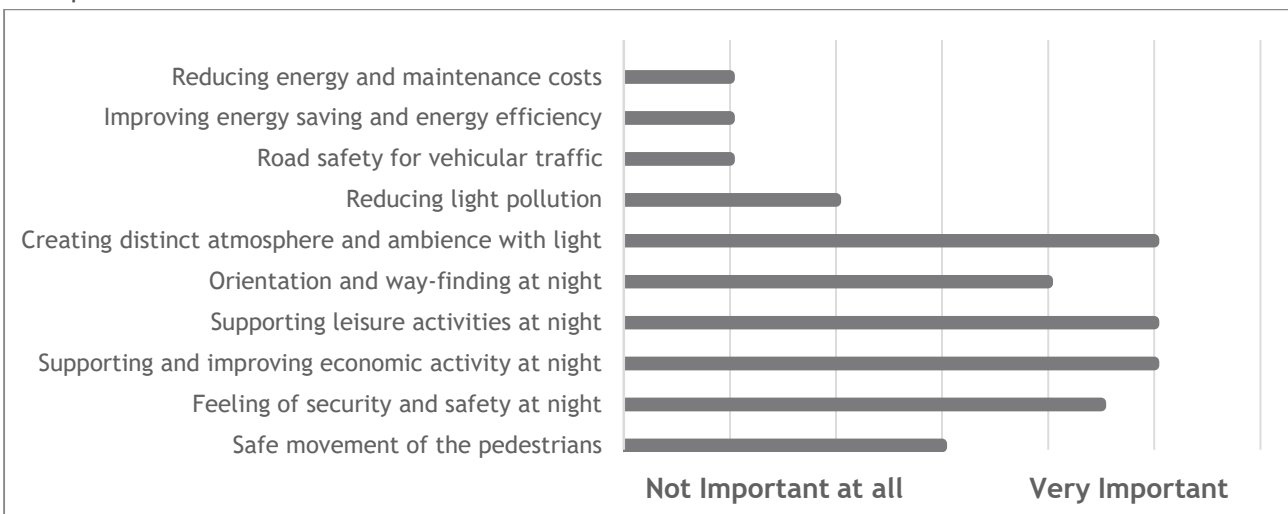


Fig. 5, Town of Sušice, Fuction of the public lighting

The table above overviews restaurants (2) which took a part in the survey. From the general point of view, we seek causal relationships between a network of factors that influence level of “happiness of their customers” and explain their willingness to visiting their restaurants. Raising from the conducted questionnaire survey, the core requirements of public lighting due to the restaurant are Creating distinct atmosphere and ambience with light, supporting leisure activities at night and Supporting and improving economic activity at night. Contrary, energy and maintenance costs, energy savings and road safety for vehicular traffic are not an important issue for the restaurants located in park “Santos”.

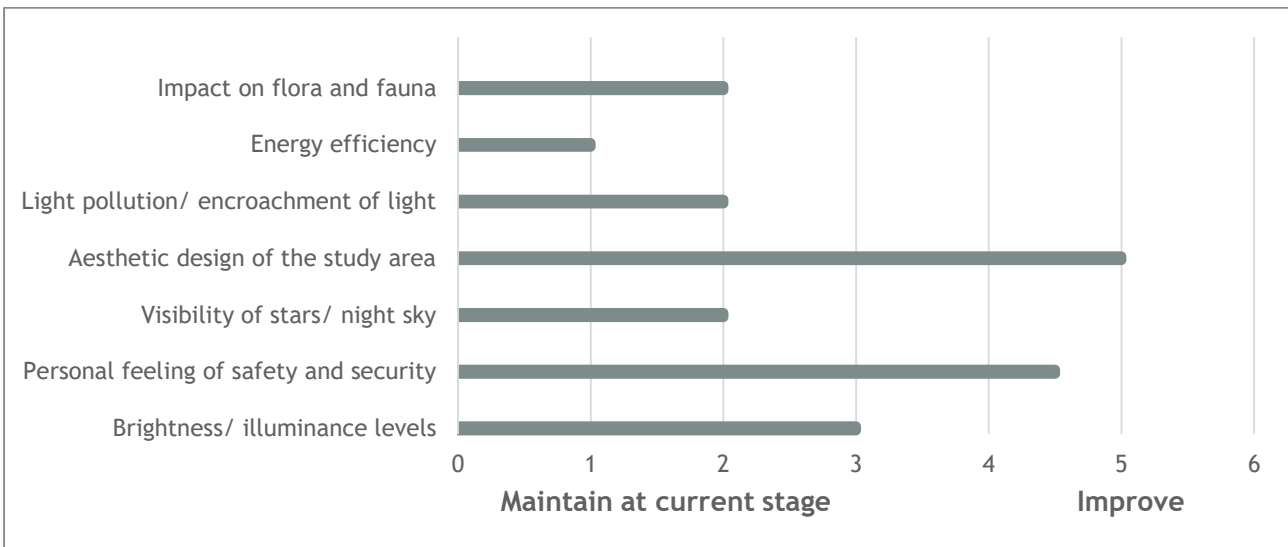


Fig. 6, Town of Sušice, The expectations of the restaurants representatives

The expectations of the restaurants from lighting control strategies are visualised in chart above. As the main expectation is mentioned improvement of aesthetic design and safety. Among less important expectation belongs aesthetic energy efficiency and impact on flora and fauna.

2.1.1.3. Foundation Proměny Karla Komárka

Nadace Proměny Karla Komárka is foundation which ensured reconstruction of the segment of the park in 2013. From the general point of view, the foundation is favoured for renovation of public lighting under the condition of limited changes in overall aesthetic design of park “Santos”.

2.1.1.4. General public

The overall impression of general public on the quality of public lighting in the pilot area is satisfactory. This is given by their low expectation about public lighting quality partly. At the same time, more than 40 % of park users are not using it during the night-time, therefore they do not care. Regarding the purpose which have the citizens attending the park, observed purposes are almost equal to each other (thanks for the location of the park in the city centre, mainly).



Fig. 7, Town of Sušice, Citizen’s purpose of using the park



The interesting results were received regarding citizen’s satisfaction with the quality of illumination in the park. Mostly the people were satisfied, especially the elderly people, who were completely satisfied with the current lighting situation because they usually visit the park during the daytime. Only 24 % of respondents are unhappy with the quality of public lighting.

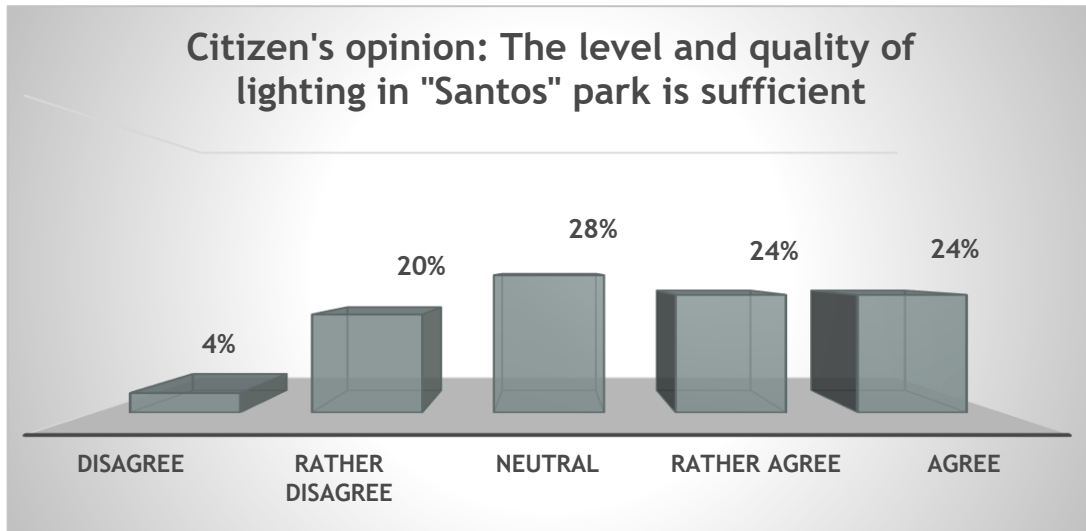


Fig. 8, Town of Sušice, Citizen’s opinion on the quality of public lighting

According to the results of the survey took place in the Santos park, 60% of citizens are not aware about the public dynamic lighting. Another 24 % answered that they are, somewhat aware which in general might mean that these people have just heard something about that or they consider something different but not the public lighting. The conclusion is that only 1 from 6 citizens is aware about dynamic public lighting (see figure below).

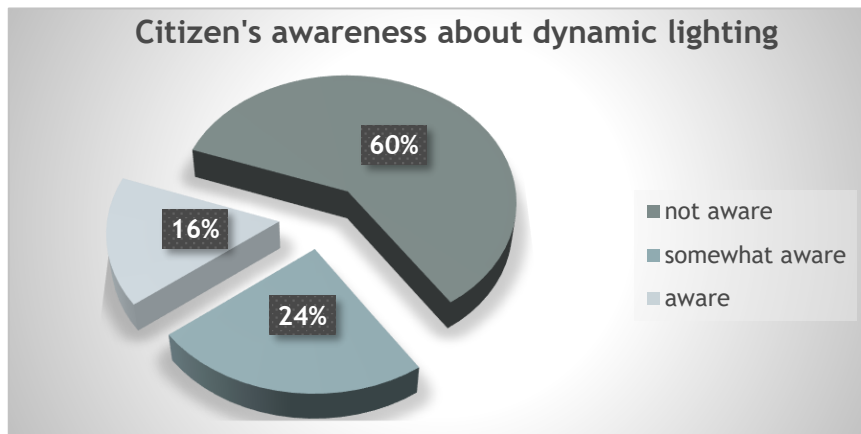


Fig. 9, Town of Sušice, Citizen’s awareness

Among general public basic attitudes and requirements, we can include:

- Improvement of public lighting at “sub-zones”.
- Reduce the distance between poles.
- Light the dark parts of the roads up.



2.1.2. Analysis of final users

According to results of the survey, the majority of respondents use the park "Santos" a few times per week (52 %) for all types of activities such as cycling or walking, relax meeting with friends for a dinner or drink, walking and playing with children and dogs, jogging and other sports. 16 % of the respondents visit "Santos" park everyday but only in a day time.

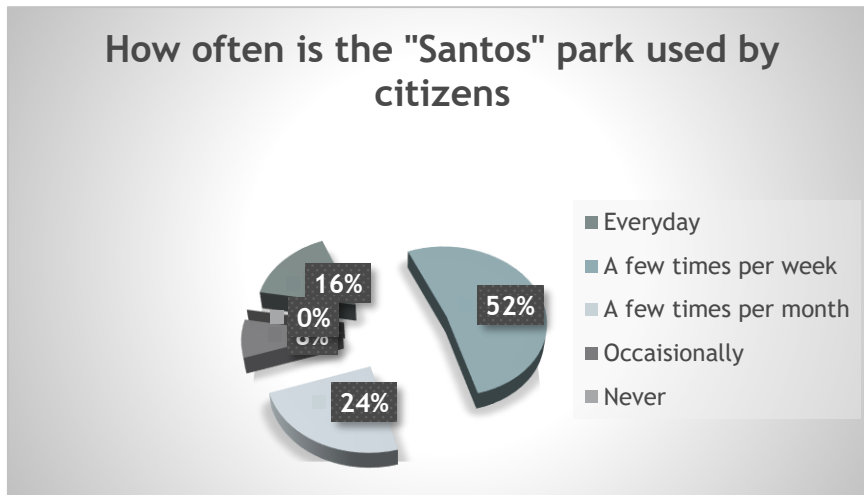


Fig. 10, Town of Sušice, Citizen's using of the park

Never the less 64 % of all respondents use the park as a transit area because of its location in the city centre (25 % using the parky as a transit area only). This is an important issue which should be held in mind when designing the dynamic public lighting.

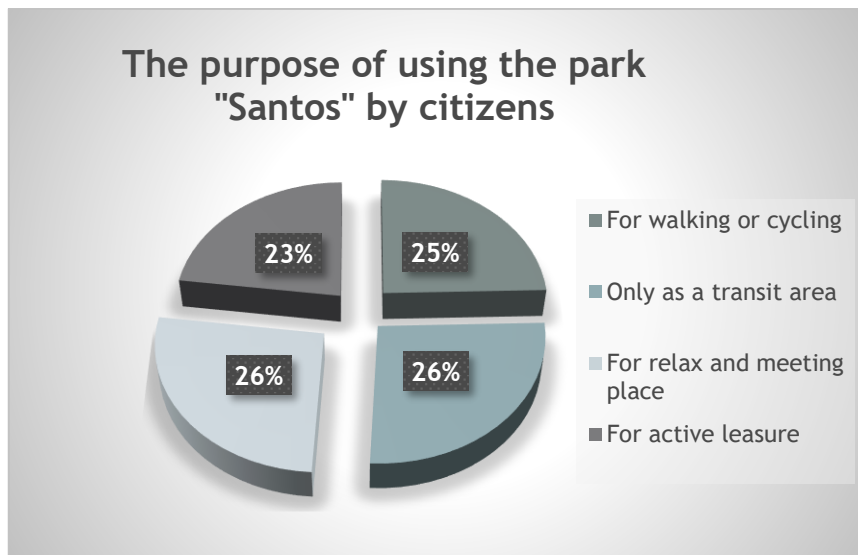


Fig. 11, Town of Sušice, Citizens of using the park

According to the results of number of visitors monitoring during working days and non-working days and citizen's preferences to visit the park it can be possible to extrapolate the data were taken in spring to the rest of the year attendance. The results show that 95 % of respondents visit the park during the summer as it is a popular place for leisure activities. The autumn time is quite similar to spring time. In winter the attendance is two times less compare to summer time due to cold weather, less sun and snow on the paths.

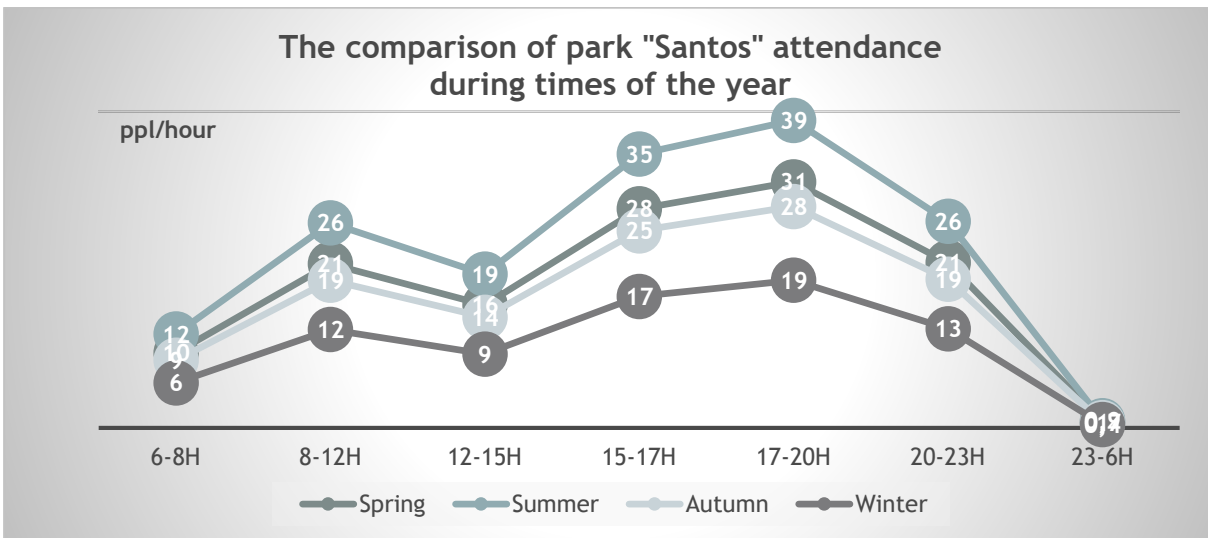


Fig. 12, Town of Sušice, Citizens attendance during the year

Total number of visitors during the working day:	320
Total number of visitors during the non-working day:	444

The attendance during the day differs depending on hours of the day and type of the day (working day and non-working day). The results of monitoring are showed on the diagrams below. On a working day in the early morning people visit the park on their way to work/study and some people come with children and dogs. The same people come back from work/study between 17 and 20 hours. The popular time for active leisure activities and recreation is between 8 and 20 hours. At this time mothers usually visit the park with babies for walking and play on a playground, elderly people come for walking and people of all ages use the park for cycling. After 15 o'clock the park is used for meetings after work. There is a restaurant in the centre of Santos island which people visit for diner and/or beer after work.

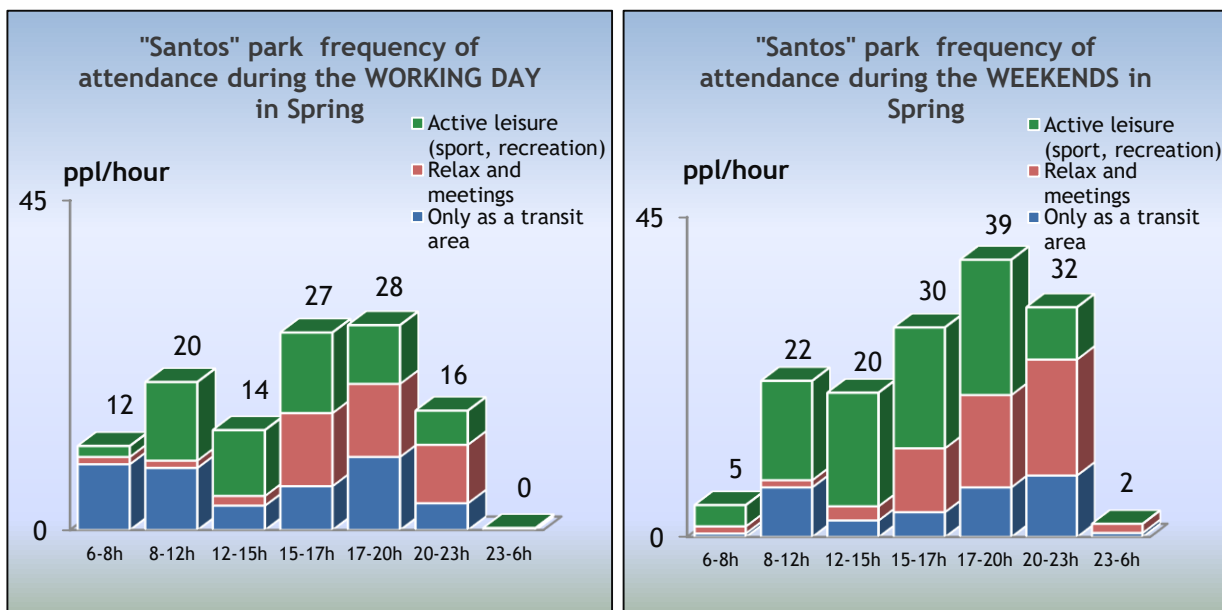


Fig. 13, Town of Sušice, Citizens frequency of attendance

On the weekend less people visit the park as a transit area, more people come to park on purpose. The attendance with the purpose of sport and recreation activities is highest from 8 o'clock and it stays until 20 o'clock on the same level. After 15 o'clock the visitors start to come with the purpose of meeting friends and visiting the restaurant. The attendance grows during the evening and falls after 23 o'clock. However,



during the night still there are some visitors in the park on weekend while on weekdays almost nobody is there.

2.1.3. Analysis of expectations and needs of final users

In the end of the survey a few questions regarding citizen’s opinion about changes in park public lighting were asked in order to get an idea whether the people consider improvements as positive or not. The respondents were divided into few groups which are those who are satisfied with the current situation and they are neutral to any changes, those who are satisfied but agree or rather agree about any improvements and those who are not satisfied and want the changes.

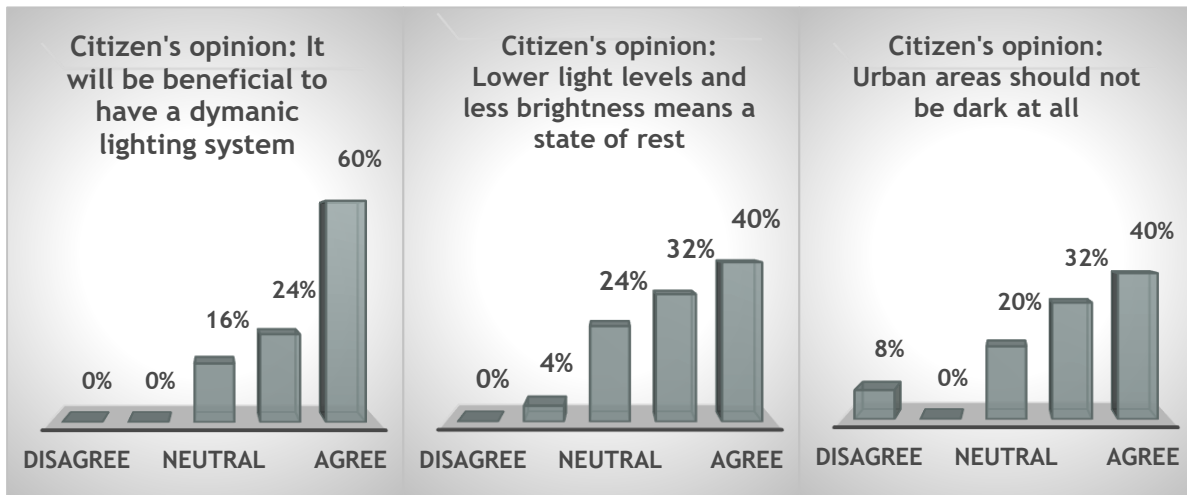


Fig. 13, Town of Sušice, Citizens opinions

Using the opportunity a few respondents were complained about too much public lighting near their houses, so they gave negative answer on the question about the lit urban areas. However, there are no private houses near the park so the park lighting cannot effect on them. The high percentage of “agree answers” shows.

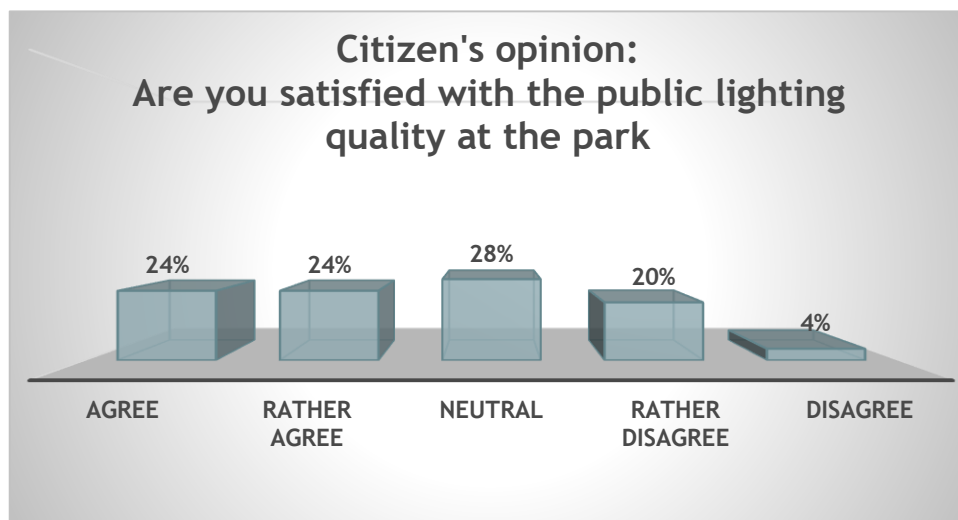


Fig. 14, Town of Sušice, Citizens satisfaction with public lighting quality

The figure above showed that almost half of the respondents are satisfied with the public lighting quality at the park. Contrary, only 8 % of the respondents do not want to improve the public lighting.

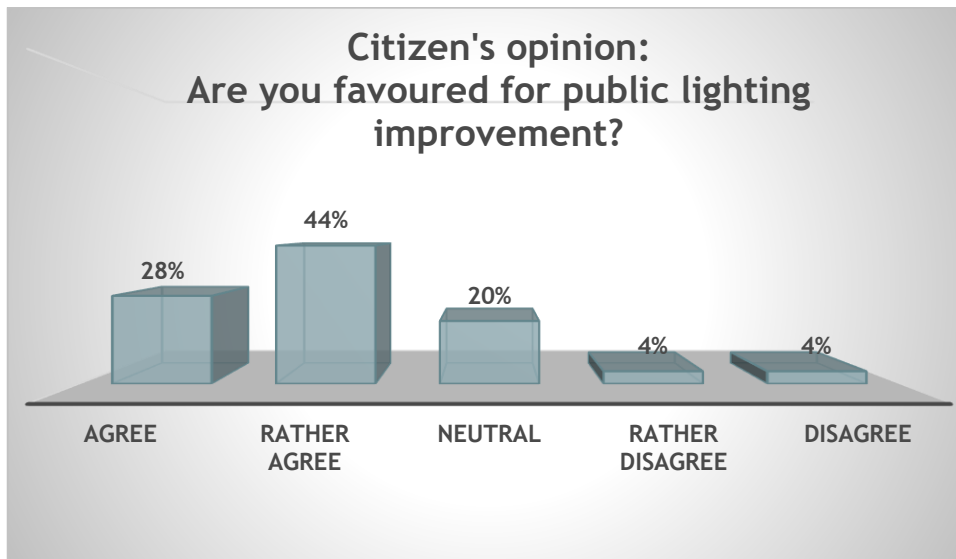


Fig. 15, Town of Sušice, Citizens satisfaction with public lighting quality

Among user's basic attitudes and requirements, we can include:

- Improvement of public lighting at "sub-zones".
- Reduce the distance between poles.
- Light the dark parts of the roads up.
- Improve the quality of lighting at two "trouble-spots".
- Improve the visibility in the parking slot.
- Improve light for playground in the night.
- Improve the illumination of certain parts of the park as appear dark completely.

2.1.4. Overall stakeholder requirements

Derived from the questionnaire surveys and interviews with key stakeholders, following requirements have been identified regarding dynamic public lighting investment in the park Santos.

Illumination of certain parts of the park is low and appear dark completely.

The luminaires are situated far from each other.

No proper light for playground.

Being afraid to hit someone with the bike.

Drivers have low visibility in the parking slot.

Improve aesthetic illumination during the town festivals.

Improve the public lighting energy efficiency.

Reduce maintenance costs.

Solved problems with trouble-spots.

3. Built environment

3.1. Analysis of changing lighting requirements in space

- **Street, walkway and pedestrian zone geometry**
 - The area in urban park of town Sušice is used by pedestrians, cyclists and by other residents for various free time activities. Whole area contains walkways of width by 4 meters along a river and into a forest park. In Santos Park are placed a playground, small pedestrian zone through urban greenery with benches and open area near the restaurant.
- **Prominent open spaces, Primary traffic routes**
 - Inside the specified area there are no prominent open spaces except the playground. A traffic route is placed on edge of the Park. The traffic route connects two parking lots with a main road
- **Pedestrian routes- Resident movement, office workers, recreational, tourists etc.**
 - Pedestrian routes are used primary by residents during afternoon and night for relaxing activities. In summer are pedestrian routes used by city visitor and tourist especially during city celebrations. Routes in the park can be seen in Fig. 16.



Fig. 16, Town of Sušice, Pedestrian routes in the park Santos - white marked (main road - yellow marked)

3.1.1. Designed changes

Around the summer restaurant (Trouble spot 2) are missing lighting poles. The area should be added by at minimum two poles with suitable luminaries (Fig.17). In Fig. 18. is marked the trouble spot area with a detail in Fig.19.



Fig. 17, Town of Sušice, Summer restaurant with the detail of lamps

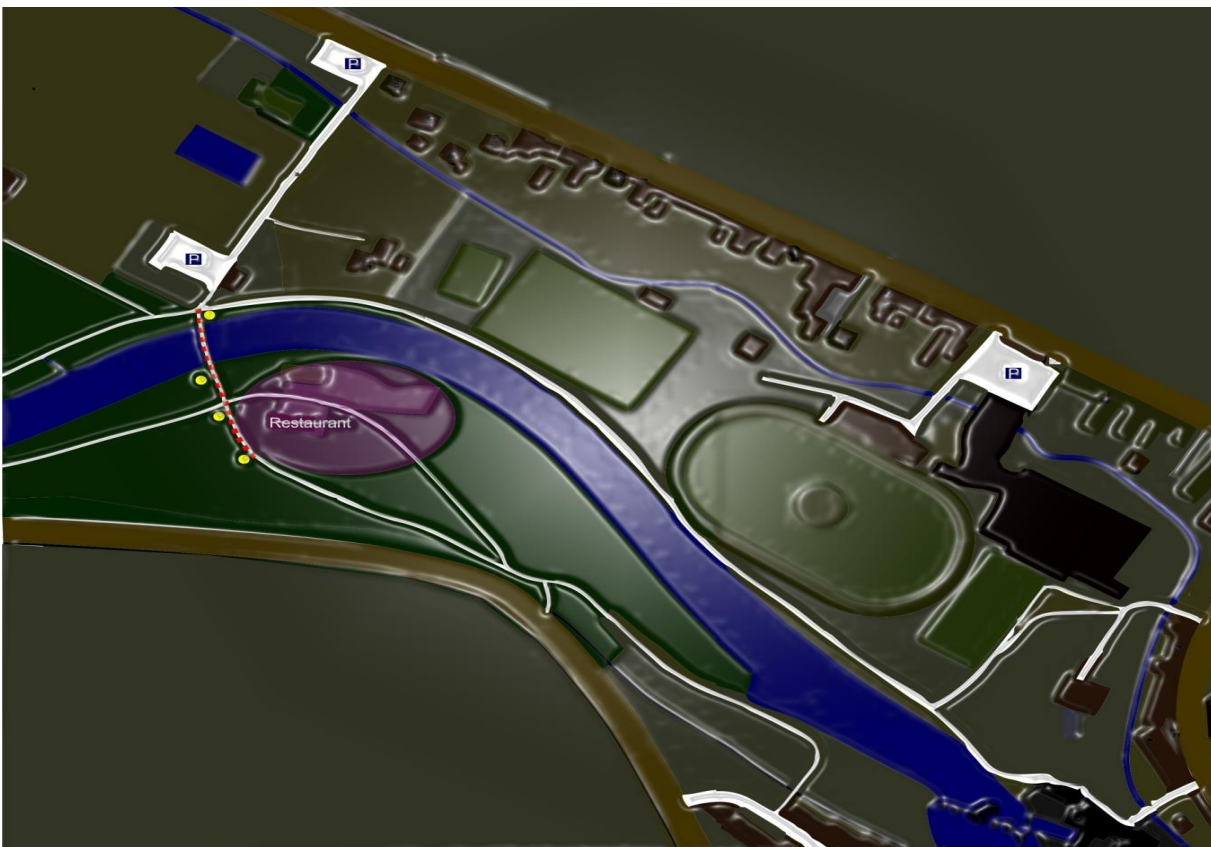


Fig. 18, Town of Sušice, Trouble spot area around the restaurant.

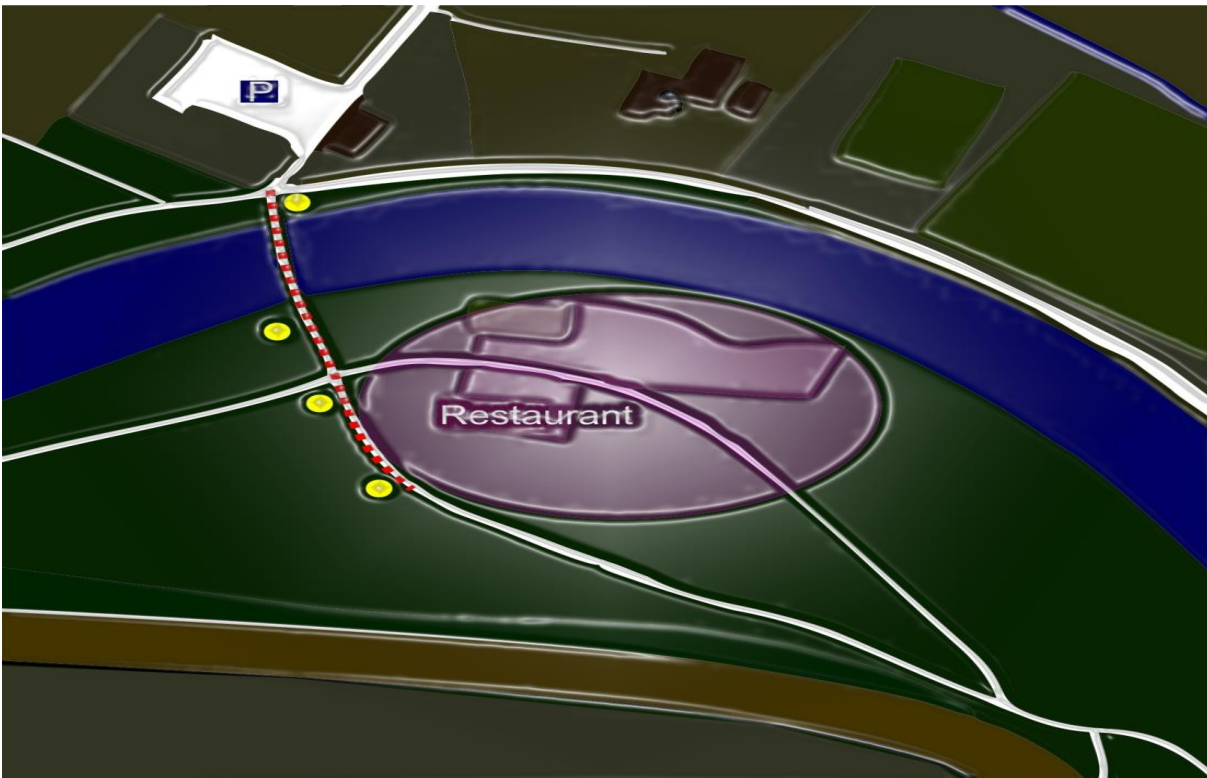


Fig. 19, Town of Sušice, Trouble spot area around the restaurant.

Figure 19 shows the trouble spot area 2 around the restaurant. Red-dashed line shows (in part) the present situation of poles placing. The connection between the park and Island (where is the restaurant) is provided by thin bridge without the illumination (Fig. 20). The bridge is illuminated from the route by an aged luminaire (Fig.21).



Fig. 20, Town of Sušice, Bridge connecting Santos with island



Fig. 20, Town of Sušice, The detail of aged luminaire which provides the illumination of the bridge

Trouble-spot 1 (Fig.21), reconstruction of public lighting, specific requirements due to the flood plains and grouping youngsters.

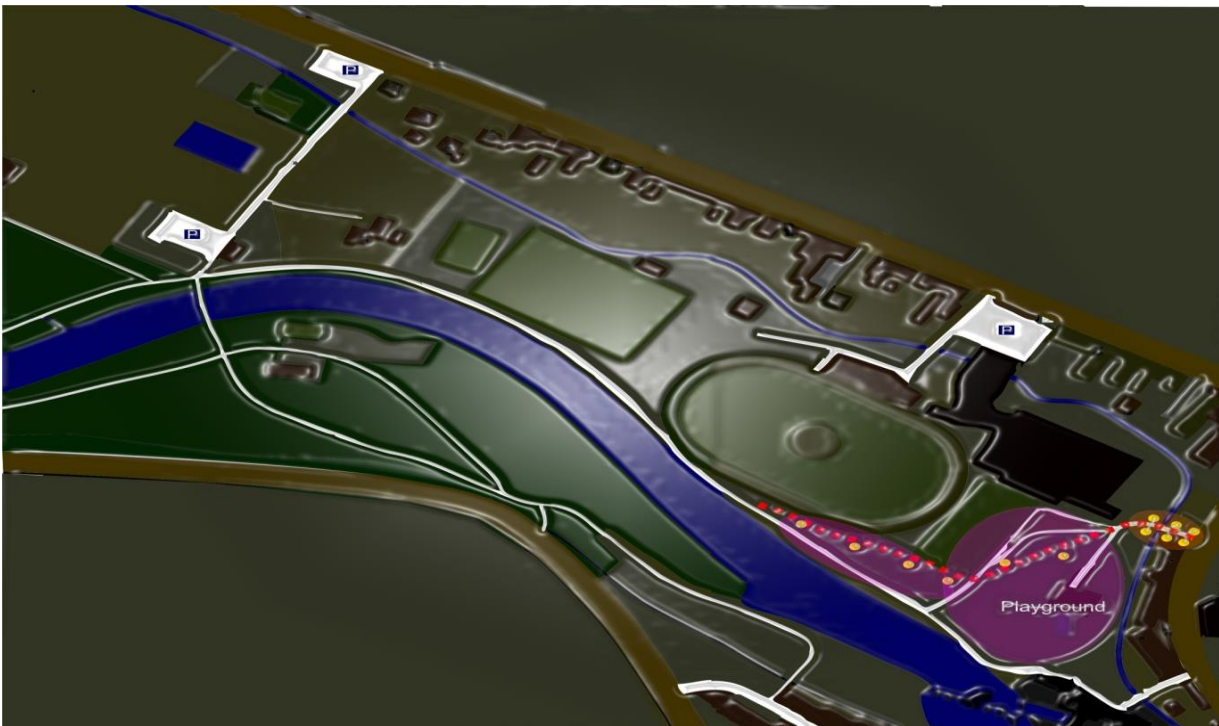


Fig. 21, Town of Sušice, Trouble spot area 1

New public lighting is needed in trouble-spots areas and in areas with poor or no lighting system. In the trouble spot area 1 there are several issues See the Fig. 22.

- Around the playground “Off Park” is poor lighting system with only several luminaries. The distances between poles are high and a road offset too. (Fig.23)

- Four poles are placed out of the pedestrian route. Pedestrians are walking through the forest (Fig. 24).
- Entrance to the park from main road is illuminated with several inappropriate luminaries. (Fig. 25)

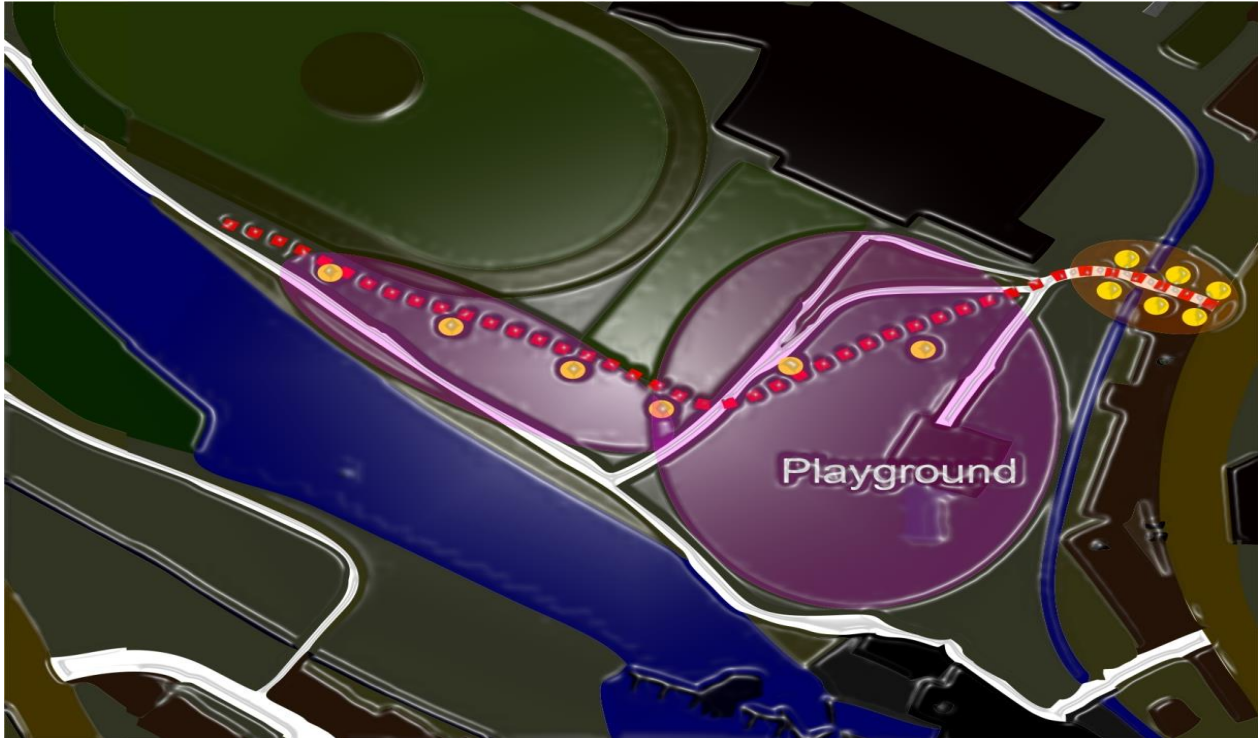


Fig. 22, Town of Sušice, Detail of the trouble spot 1



Fig. 23, Town of Sušice, Playground in “OffPark”



Fig. 24, Town of Sušice, Poles (in red circle) are placed in the forest, dozens of meters from the pedestrian road



Fig. 25, Town of Sušice. Illumination of the entrance into the park

Traffic road which is used by pedestrians or cars and ensuring access to the locality is accessed by two parking places. Around the both parking places, there is missing any lighting system, there. Only two poles are installed on road which is used by pedestrians too (Fig. 26, 27.,28.). In side-part of the park, there is no public lighting system installed. These routes are marked orange-dashed line in Fig. 26,27.

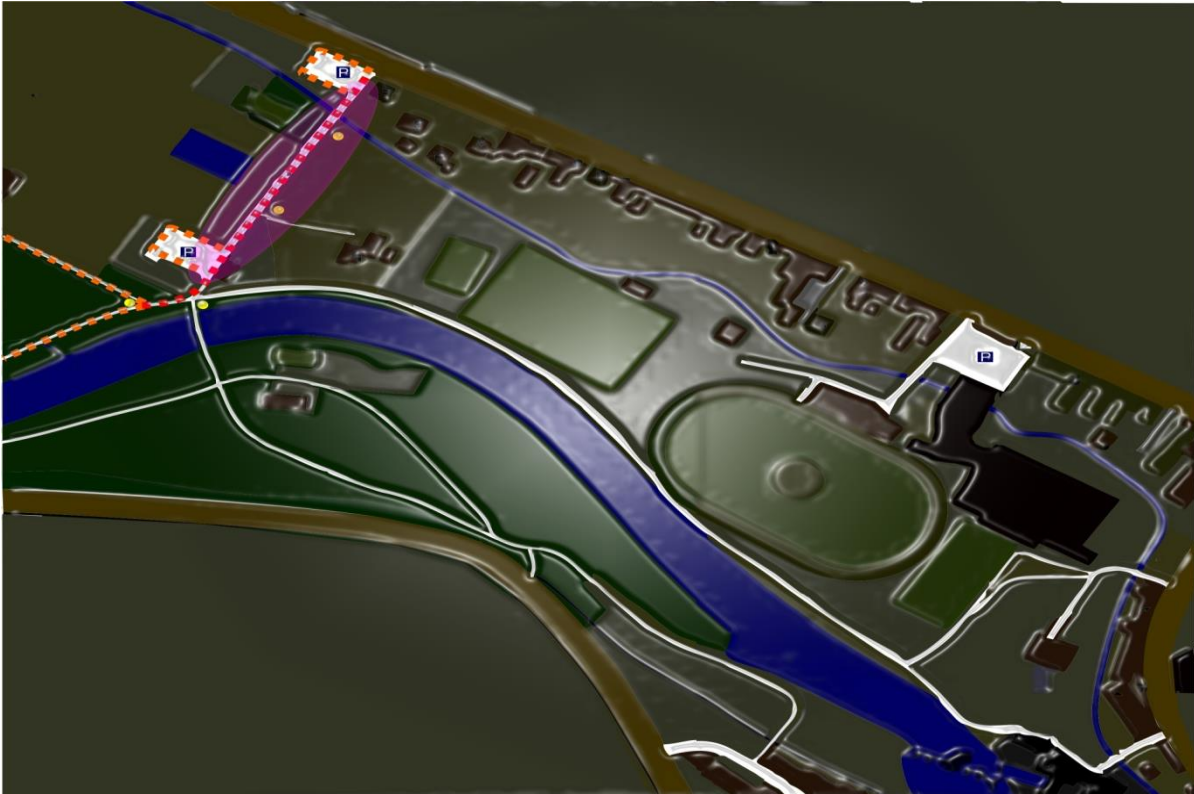


Fig. 26, Town of Sušice. Traffic road

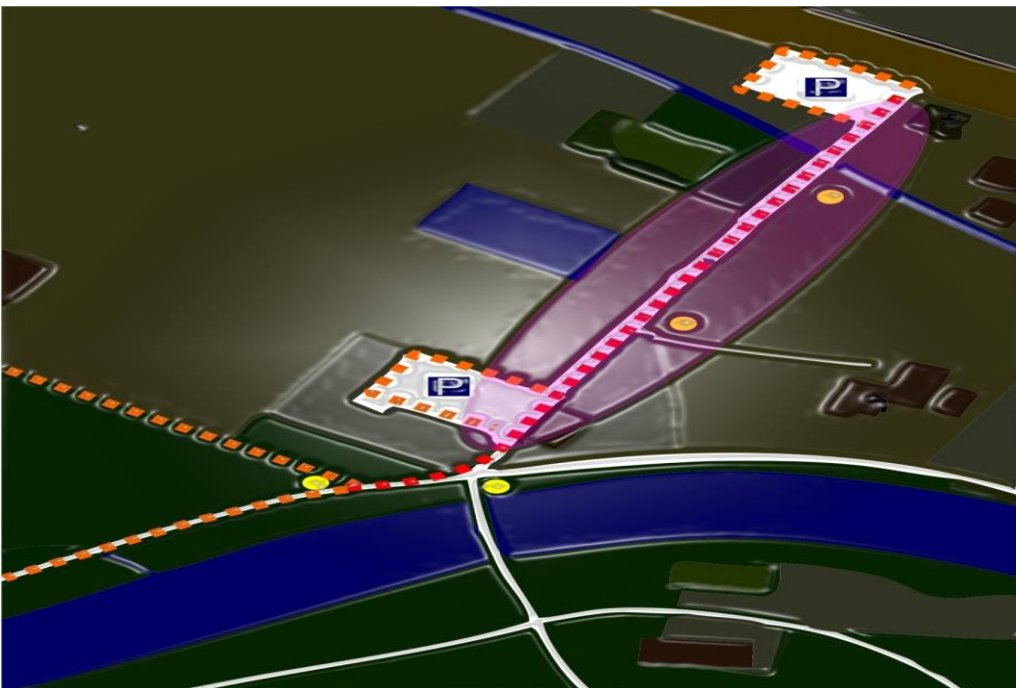


Fig. 27, Town of Sušice, Parking places



Fig. 28, Town of Sušice, Current lighting system of the parking place

Suggested Changes:

- Around the summer restaurant
- Playground illumination
- Trouble-spot 1 and Trouble-spot 2, reconstruction of public lighting, specific requirements due to the flood plains and grouping youngsters.
- New public lighting in poorly illuminated parts of the park.

3.2. Understanding prominent landmarks, features and space determining public lighting

In the park, there is no prominent landmark. As is has been mentioned in previous chapter, two trouble-spots are located in the park, described above.

3.3. Developing dynamic lighting recommendations to meet requirements and demand

3.3.1. Type of light sources, luminaires, sensors and etc.

The pilot area will be equipped by park lighting poles with short arm in place of current poles except several lighting poles which is needed to be relocated.

All used LED luminaires will be equipped by autonomous driver to ensure dynamic control. Used LED modules in the luminaires have to use a technology to ensure constant luminous flux of LEDs in the process of aging.

The dynamics control will be provided by several methods. The base method is the driving of luminance or illumination according to time schedule. The time schedule is variable in time and is dependent on the season. Time schedule of the lighting points can be different.

The other control element is an ambient illuminance sensor (twilight sensor). Each group of light points in one zone will be controlled separately. If it is needed the group of light points could be equipped by additional twilight sensor sensors.

The next controlling is based on presence sensor (light and motion sensor). The presence sensor ensures several tasks. The sensor detects the occurrence of people in the viewing area. Next task is tracking the direction of movement and analysis (prediction) of direction of further movement. The prediction is calculated by control gear of dynamics lighting. The last task of the movement sensor is recording the number of passing-through people.

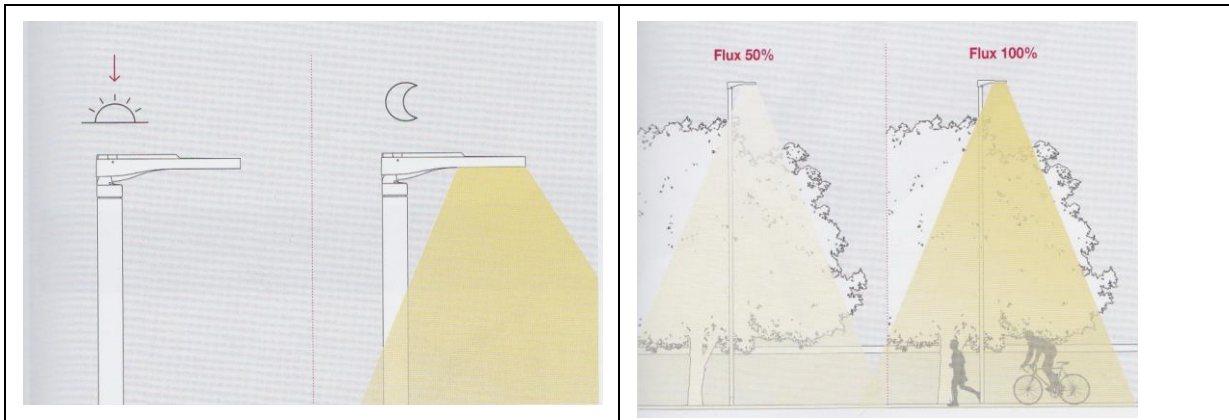


Fig. 29, Town of Sušice, Draft of dynamic lighting control (source: iGuzzini)

The placement of the motion sensor depends on the geometry of the illuminated area and on the design, position of the light points.

4. Lighting analysis and conditions survey

4.1. Analysis of the existing lighting conditions

Street lighting system is installed along walkway of 4 meters' width, mainly. The lighting poles are 6 meters high without arms. More than half amount of the poles is older than 30 years (Fig. 30). Almost all poles are placed in one line between full-grown trees. Several light poles are placed out of the location where are needed and it must be shifted (see Fig. 24.).



Fig. 30. Town of Sušice, The example of obsolete pole, all installed lamps have no arm and are mostly shaded by trees

The lighting system is equipped by luminaires with poor efficiency and inappropriate photometric properties (Fig. 30). Moreover, the luminaires are shaded by trees (Fig.30) In luminaires, 70-watt high pressure sodium lamps are installed with conventional electromagnetic ballast. In park Santos, 19 pieces of these lamps are installed at all.

Part of the park Santos is renovated; the lighting systems with modern luminaries is installed, as it is shown in Fig. 31. Total amount of this luminaires is 17 and are equipped by 70-watt metal-halide reflector lamps. This part of lighting system will be partly renovated. It is suggested that electromagnetic ballast will be changed for dimmable electronic ballast with daily system control. Finally, whole lighting system will be equipped by other sensors and autonomous control gear. The existing lighting system is not controlled anyway.



Fig. 31. Town of Sušice, Type of luminaries of partly renovated area

4.1.1. Lighting measurement

In the park, two types of luminaries are mounted. First type of luminaire is shown in table below. The measured data of illuminance are in Fig. 32. From overall perspective, the lighting condition is poor in the park and insufficient (see figure 33).

Luminaire properties	
Luminaire	Modus Auris 600
lamp type	HPS-T (2000K)
output [W]	70
spacing [m]	25
pole height [m]	6
width of road [m]	4
side offset [m]	0,8




Fig. 32. Properties of the lighting system, Modus Auris 600

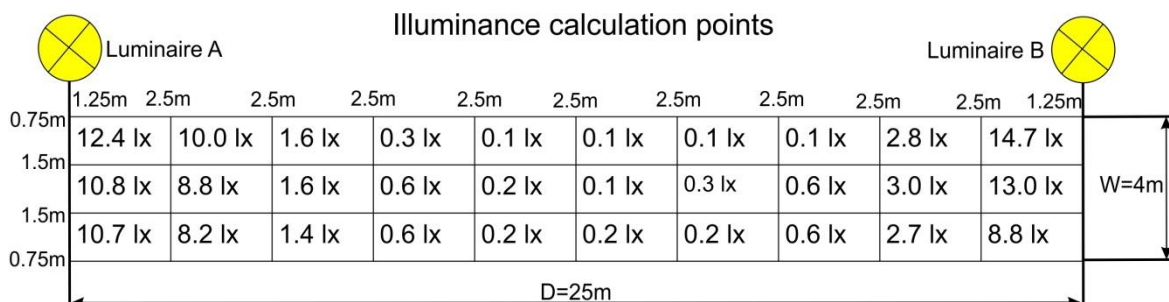


Fig. 33. Illuminance measurement



Fig. 34. Illuminance measurement, Place of the lighting measurement Modus Auris 600

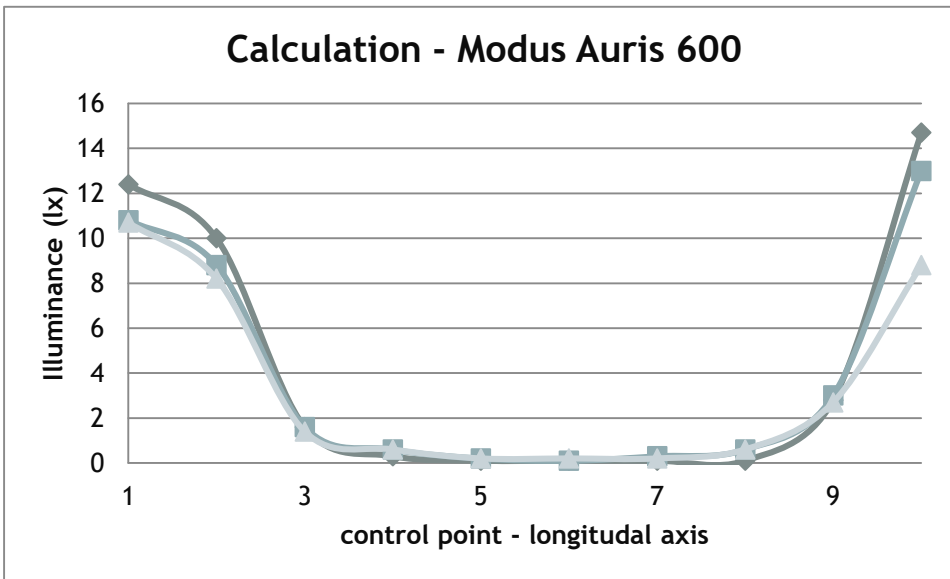


Fig. 34a. Result of the illuminance by Modus Auris 600

Second type of luminaire is shown in table below. The measured data of illuminance are in Fig. 35. From overall perspective, the lighting condition is poor and insufficient (see figure 36).

Luminaire properties	
Luminaire	Honor Citylux
lamp type	HCI-R (3000K)
output [W]	70
spacing [m]	25
pole height [m]	3,6
width of road [m]	3
side offset [m]	1




Fig. 35. Properties of the lighting system, Honor Citylux

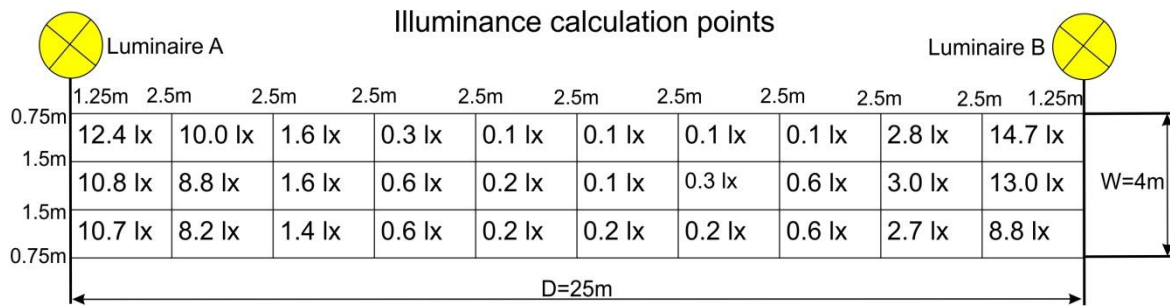


Fig. 36. Illuminance measurement, Honor Citylux



Fig. 37. Illuminance measurement, Location of the lighting measurement Honor Citylux

4.1.2. Evaluation of key indicators to track the benefits of dynamic public lighting

The comparison of the new dynamic controlled lighting system with the present will be based on comparison of several parameters, which are expected to be much better at new designed lighting system.

- The photometrical quantities:
 - o Colour rendering index
 - o Illuminance and light uniformity
 - o Operating life
- Energy consumption:
 - o Dynamic light control system
 - o Luminaire efficiency
 - o Energy consumption
- Maintenance costs
 - o Monitoring
 - o Operating costs.



- Safety and Aesthetic quantities
 - o Feel of safety
 - brightness and colour temperature
- Light Pollution
 - o Number of luminaries
 - o Light utilization factor

Expected Specific indicators:

	Before	After
Illuminance (lx)	<4	>5.8
Light Uniformity (-)	0.02	0.1
Rendering colour index (-)	20 – 60	>80
Lamp life (h)	25 000	50 000
Colour temperature (K)	2000	3000 – 4000
Efficiency (%)	<75	>95
Energy consumption (-)	1	0.7-0,6
On-line control	no	yes
Monitoring	no	yes
Safety	Poor	Good
Comfort	Poor	excellent