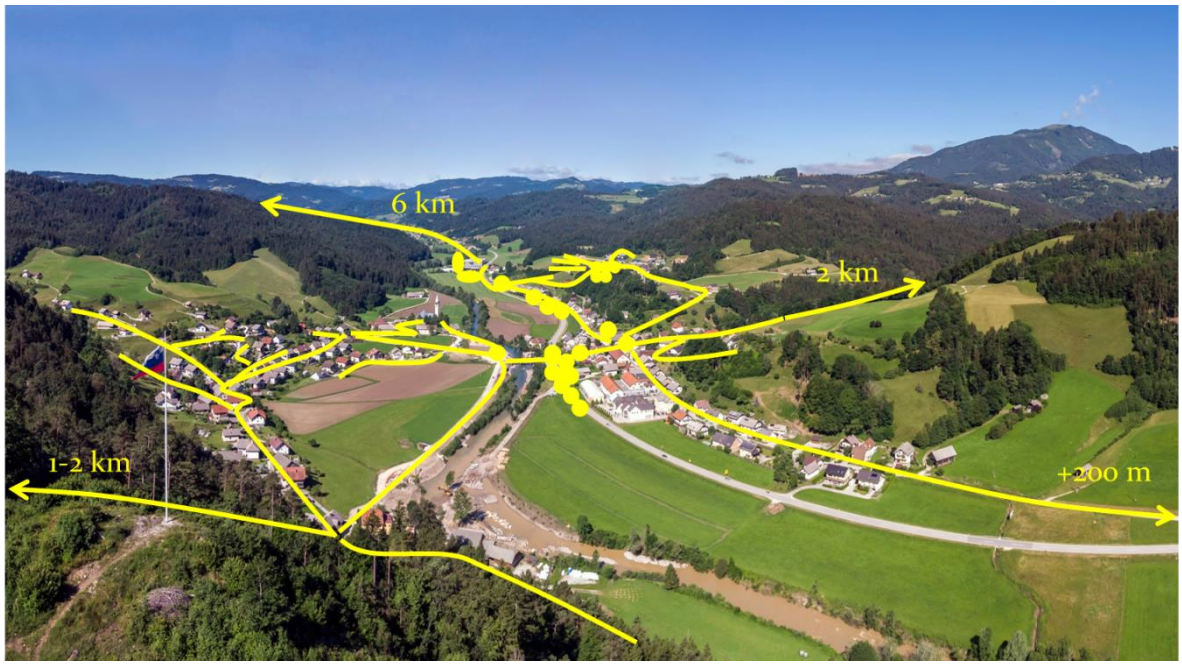
Light Pollution and Landscape Degradation by Outdoor Lighting

Present Situation and Solution Proposals



(Example of perspective in a specific area if trends continue)

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**Note: The document is machine translated from Slovenian to English and only briefly edited*

Content

1. Introduction

The document presents concrete examples of the negative impacts of outdoor lighting. Indicative proposals for solutions are listed as well as responsible institutions for their implementation. Further discussion is needed in individual cases to further define solutions and implementation steps.

Some of the problems highlighted below overlap in part, but are explicitly presented in order to sharpen the perspective. Since at least in Slovenia the main part of the contribution to light pollution and the aesthetic degradation of space is the lighting of traffic surfaces, the related cases are also represented above average in this document.

In order to facilitate the performance, there are concrete examples of individual problems, but they are not systematically selected. Most of these cases are from areas of Gorenjska and central Slovenia, but in fact the situation is similar across the country.

Since the Ministry for Environment Protection and Spatial Planning (MOP) is responsible at the umbrella level for the regulation of the situation and the detailed knowledge and alerting of problems comes from organizations and individuals with environmental knowledge and experience, the participation of MOP and environmentalists is required in regulating all the problems listed below, even if they are not explicitly listed as responsible.

2. Problem Overview

The awareness that artificial light to the extent we use today is a serious environmental problem is becoming widespread in recent decades, and despite some successes in technical emission management, with the widespread expansion of lighting, the problem is virtually completely unmanaged in practice and trends lead in the direction of an all-ensuing environmental and spatial catastrophe. This is the case on a global scale, and in some countries, which unfortunately also includes Slovenia, it is particularly pronounced.

Significantly less than the sub-problem of light pollution, the impact of installations of external lighting (especially traffic surfaces) on the aesthetics of the space (landscape, settlements) or on the associated ubiquitous urbanization and alienation from the natural environment is addressed. **Although, in essence, the absence of comprehensive spatial planning is the primary problem, which also results in the environmental problem of light pollution, the issue is practically always seen narrowly in the context of limiting light pollution.** There is supposed to be nothing wrong with the uniform colonnades of tall grey metal poles with planted industrial lamps on the roads through the green fields, if we manage to limit the light, escaping to the sky. If not when we are all upright and have the opportunity to experience the space in which we live, then at least those few hours in the middle of the night when we all sleep.

In the past, the illumination of traffic areas was significantly more rational, only the exposed points were illuminated. Due to the different approaches and application of standard EN 13201, today illumination is significantly more extensive and intensive, both in terms of the extent and intensity of illumination of individual road objects, as well as in terms of the choice of illuminated facilities or areas. **Existing trends lead to total illumination of entire populated areas, entire regions and the whole**

country. Instead of total illumination, we should strive for "light" lighting, with significantly more rational assessments of what and how much it needs or is allowed to be illuminated. Without a thorough reset of the attitude to the lighting towards more realistic and comprehensive needs and impact assessments, tackling the problem cannot be successful.

The need for illumination is typically greatly overestimated, and the security argument is often abused. For example, a turn-off for a pump on a relatively congested regional road has been operating for decades without any traffic and safety problems, but in the case of new construction, an unlit turn-off cannot be imagined at all. The need to illuminate is also greatly overestimated for sidewalks and side paths through settlements, through which safe walking without illumination, which has to be very uniform, is supposed to be impossible. In a large part the problem is caused by the strict use of **the exaggerated recommendations of standard EN 13201**, which for many sites prescribe non-realistic and environmentally unacceptable illuminance intensity and uniformity.

The issues can be divided into the following levels:

- Illumination in too many locations (e.g. systematic lighting of the whole countryside, regardless of needs and cumulative effects)
- Very extensive lighting of individual objects (e.g. roundabouts, intersections)
- Intensity of illumination (technical rigid consideration for many cases of unrealistic and unacceptable requirements of EN 13201)
- Light spectrum
- Aesthetic aspects: spatial distribution and height of lamps, design of lamps and columns (domination of spatially and aesthetically unsuited lamps above the landscape and settlements)

The main source of the problem is in non-critical lighting in many locations, even with negligible needs, so the bulk of the effort must be focused on defining the criteria on the basis of which illumination is permitted. The problem will not be managed if illumination continues to be allowed regardless of the level of needs and regardless of the cumulative negative environmental and spatial effects caused. By administrative structures, including the MOP (Environment Ministry), the illumination is instead seen as an absolute right that belongs evenly to all citizens, regardless of the location of the stay. **On the second level, provision should be made for a significant reduction in the encompassed area and intensity of lighting of individual objects**, especially on traffic surfaces. On the third level it is necessary to address aesthetic aspects (influences on the appearance of the landscape and settlements, design of lamps), which are now practically completely overlooked.

At the root of the problem are two main strands, which by far the most contribute to the degradation of the environment and space through artificial lighting:

- Very intense and landscape-unadjusted systematic illumination of transit connections (competent: DRSI and DARS; *Slovenian state roads and highways companies*)
- Uncontrolled expansion of road and street lighting to all populated areas and links between them, irrespective of actual needs and cumulative environmental and spatial effects (competent: municipalities)

Tackling the issue requires fundamental ethical, aesthetic and utilitarian considerations in relation to the management of the environment and space on the basis of which relevant policies must be based. Instead, in practice, lighting placement is mostly considered only at the most basic utilitarian level. Thus, especially in the case of road and street lighting, only technical experts, who are partly limited by the existing regulation from an environmental point of view, are concerned with the placement of the lighting, and virtually entirely landscape architectural and wider urban planning considerations are absent. Following the state of theoretical processing of the problem, also comprehensive policy of its management at the state level is very much absent and, consequently, at the local level.

In this context, it is necessary to highlight the misunderstanding and underestimation of the problem on the part of the MOP, which is the first responsible for regulating it. Both the estimates and the starting points of the head of the Task Force on the Novella of the Regulation and the draft of national spatial strategy state that the expansion of lighting is not a problem, but it is necessary, above all, to provide for technical measures to ensure emission reductions, e.g. by reductions in late-night hours. This means that the MOP does not have a realistic assessment of the situation and trends and problem, either alone, nor with existing consultants manages the situation. In such a situation, it is all the more understandable that a problem that is inherently relatively complex and politically demanding is not managed by anyone, so it is necessary to achieve its sufficient understanding in the first step.

The problem must be regulated at the following levels:

- Regulation on limit values of light pollution
- Slovenia's spatial strategy and spatial legislation
- Rules on traffic signalling and road equipment
- Green Public Procurement Regulation
- Internal DRSI and DARS orientations
- Standard EN 13201
- Municipal lighting plans
- Design skills
- Participation of landscape architects and urban planners in strategies, orientations and projects (urban planning arrangements)
- Market for lighting equipment
- Rational use of European and state resources
- Inspection
- Status monitoring
- Obligation Code
- Raising awareness of the population and the professional public
- ...

The abovementioned list of the most exposed uncontrolled origins of the problem and the approaches to their management further highlights how limited and underestimating the approach of the Ministry of the Environment and Spatial Planning, which seeks to regulate the problem only by directly amending the Regulation on limit values of light pollution, while actively rejects the urgent need for a wider debate on the issue. A multidisciplinary discussion is required, which cannot be limited to the mere amendment of a few articles of the Regulation, and that discussion must be carried out at all the above levels.

3. Lighting Policy Proposal

This chapter briefly summarizes the basic starting points of the policy of sustainable outdoor lighting. Proposals for concrete measures are set out in the next chapter.

Given that the problem of outdoor lighting goes beyond the environmental problem of light pollution, the lighting policy is primarily addressed in spatial strategies and spatial legislation, with the specific issue of light pollution being addressed in environmental legislation (Regulation).

The proposed lighting policy stems from an overview of the reasons why outdoor lighting is used:

1. Direct use (working processes, courtyards of private buildings, personal lamps, billboards...)
2. Safety (road safety, personal safety, security of facilities)
3. Comfort (walking and orientation in the populated area or in another location)
4. Decoration (illumination of cultural monuments, façade lighting...)

The basic starting point is that outdoor lighting is a negative and undesirable intervention from the point of view of preserving the environment and the landscape, so it is installed only when it is not possible to avoid it because of work processes, safety or comfort in public areas with a higher concentration of traffic (especially pedestrians). External lighting for aesthetic purposes is permitted only in larger urban centres and on buildings of wider importance. Any intervention or type of intervention should also be seen in the context of cumulative effects in the case of systematic implementation of such interventions in the area of the whole town, municipality, region, country ...

Ad. 1: The use of external lighting for direct use is not in dispute, with it being within technically prescribed limits and lit only at the time of use. Application to work processes is to a large extent already defined in the existing Regulation. The intense lighting of shopping centres, both facades and parking lots, is outstanding. Particular provision should be made for legal restrictions and market regulation of lamps for private and personal use.

A particular issue is advertising banners and illuminated inscriptions (e.g. names of shops, companies). Their lighting outside settlements is not allowed and within settlements it is only allowed up to a certain hour.

Ad. 2: The use of external lighting for safety needs is not disputable, but it is necessary to prevent the misuse of the concept of safety for lighting in locations where indeed it is used exclusively for convenience (e.g. side streets of small settlements), where lighting does not contribute to safety (e.g. intersections outside settlements, most bypasses) and for oversized projects (e.g. lighting of road legs at junctions and roundabouts).

Personal security shall consider the level of threat. While in larger urban centres this is slightly elevated due to the increased number of interactions and the illumination of side streets for the sake of personal safety makes sense, in smaller settlements this level is negligible and the illumination of side streets is not justified.

Ad. 3: Illumination for the sole purpose of the comfort of movement and orientation is permitted only in public areas with a higher concentration of pedestrians and cyclists. This means that for this reason, illumination is only allowed in urban centres and on the central streets of smaller settlements. The

lighting of peripheral streets of smaller settlements is not allowed due to negligible needs and extremely large cumulative negative effects.

Ad. 4: External lighting for aesthetic purposes (e.g. façade lighting) is only allowed on buildings of wider importance (especially cultural monuments, including churches). In the late night, switching off shall reasonably be prescribed.

Conditions affecting the needs referred to in points 2. and 3. may vary at different night hours and different seasons (e.g. tourist centres), so the lighting is adjusted either by shutting down most or all lamps (e.g. on roads where there are virtually no pedestrians and traffic at night) or by reducing the intensity (e.g. on roads where traffic density is significantly reduced).

Lighting outside settlements is not permitted, except in cases explicitly provided for by law. Outside major urban centres, continuous lighting is only allowed in the centres of larger settlements, areas (especially sidewalks) along more congested roads outside the centres are illuminated only in orientation and peripheral streets are not illuminated.

Quantitative restriction criteria (in the current Regulation kWh/inhabitant/year) which prevent deviations and abuses in the need assessments referred to above, are still used. The parameters must be selected in such a way as to limit the situation during the busiest hours, rather than in summary over the year. This means, for example, that we should limit the installed power per capita, rather than per capita consumption per year.

One of the major origins of the problem of over-illumination is standard EN 13201, which collected recommendations for illumination of traffic surfaces. The standard, which is produced in narrow professional circles, needs to be evaluated critically in a wider debate at European level. As this requires a longer process, it is necessary to adopt the available measures at national level as soon as possible. Restrictions on the application of the standard shall be laid down in the Regulation. The nationally specific variant of the first part of the standard (EN 13201-1) could bring illuminating classes closer to acceptable frameworks, with the need to place less laden areas outside the frameworks of the standard also in the standard's terminology, by placing these areas to the class P7, which allows designer's own judgement. This will ensure that the standard is applied only on the busiest traffic areas. Everywhere else, only orienteering lighting is being set up or only safety problematic points are illuminated. In any case, it is necessary to ensure that the standard is also considered in practice only as a recommendation for maximum lighting (in line with the recommendations of the European Green Public Procurement Regulation).

Other major sources of the problem are the recommendations of the Slovenian Lighting Society (comp. SDR 5/2000) or internal instructions of DRSI and DARS, which contribute to very extensive lighting of traffic objects (e.g. up to 25 lamps on roundabouts). It is necessary to ensure that, instead of these recommendations, significantly more environmentally and spatially sustainable approaches with significantly lower lighting are applied.

Special care is taken to consider the effects on the aesthetics of the space (landscape, appearance of settlements), which are markedly underestimated. This aspect is addressed both at the level of national policies and strategies and at the level of individual projects.

Given that the country has been very intensively degraded by over-lighting over the past two decades, a comprehensive remedial program will have to be provided.

Over the past two decades, outdoor lighting has undergone a major development, unfortunately far beyond sustainable frameworks and beyond the frameworks of coordinated spatial planning. It will be very difficult to take sufficient steps backwards, as citizens will largely not want to give up their acquired rights, and the positions acquired will be defended by the lighting profession and the lighting industry. A national awareness campaign should therefore be taken into place on this issue.

4. Concrete Problems and Solutions

The points, listed in this chapter, overlap in some places or are different levels of problem. The initial part of the chapter is about general problems, the central part deals with specific cases, and the chapter concludes with existing or recommended organizational approaches, which should be implemented effectively to manage the problem.

4.1.Negative Effects of Excessive Expansion of Outdoor Lighting

4.1.1. Increasing Light Pollution

Problem description: Despite previous measures (Regulation 2007, technical progress...), light pollution continues to increase sharply. This is due to an extremely intense systematic spread to all possible locations (transit links, all streets across all settlements and connections between settlements...) and very large-scale projects, regardless of actual needs. Although the situation is not ideal elsewhere in the world, the situation in Slovenia is markedly poor compared to the more regulated countries and is virtually completely uncontrolled in terms of managing the expansion of lighting.

Examples: illumination of residential streets in rural and suburban settlements, very extensive lighting of roundabouts and intersections, lighting of bypasses, illumination of the whole road, instead of just the pavement, illumination of connections between settlements leading to continuous illumination of the rural regions ...

Solution proposal: This is a complex issue that needs to be regulated on several levels. First and foremost, the Ministry of the Environment and Spatial Planning is responsible for its regulation.

Levels of problem solving (detailed in Chapter 2):

- *Comprehensive impact assessment, trend and cumulative impacts assessment*
- *Spatial and environmental strategy*
- *Legislation*
- *Requirements and recommendations for investors; municipal and state spatial acts*
- *Technical recommendations*
- *Design training*
- *Project verification*
- *Remediation of the present status*
- *Monitoring and inspection*

Measures:

- *Address the problem in the Slovenia's Spatial Strategy and Spatial Legislation*
- *Update of the Regulation on limit values of light pollution*
- *Update of the Traffic Signalling and Road Equipment Policy*
- *Correction of the Green Public Procurement Regulation*
- *Update of recommendations and procedures in DRSI and DARS*
- *Modernization of municipal lighting plans*
- *Limitation of the application of standard EN 13201 in the Regulation and adoption of the nationally specific first part of the standard (SIST EN 13201-1)*
- *Proposals for amendments to EN 13201 at European level*
- *Integration of spatial and environmental content into projects*
- *Project-specific audit procedures*
- *Update design education and licensing*
- *Increasing the efficiency of inspection services*
- *Removal of excess lighting*

Responsible: MOP, MZI, MJU, DRSI, DARS, municipalities, SIST, SDR ...

4.1.2. Impacts on Landscape, Urbanization, Character Change of Entire Regions

Problem description: Negative impacts on the appearance of the landscape, inadequate urbanization and ultimately intensive character changes of the whole regions and countries are becoming increasingly evident, while being almost entirely overlooked and unaddressed in the legislation and planning procedures. The absence of landscape architectural and urban design content in public lighting projects (usually part of road renovation or construction projects) is one of the main causes of inadequate lighting placement.

Examples: completely changed character of rural areas, despite negligible lighting needs, "forests" of high poles around roundabouts and intersections in the middle of open fields, kilometres of continuously lit areas through and between villages, high poles through settlements and in front of their veduta, illuminated bypasses, steel poles in the middle of natural areas, universal use of industrially designed lamps ...

Solution proposal: A missing theoretical assessment of the effects of lighting and artificial light installations on the space is prepared. On this basis, measures are taken at different levels.

Measures:

- *Preparation of a theoretical assessment of the effects of lighting and artificial light installations on space*
- *Address the problem in the Slovenia's Spatial Strategy and Spatial Legislation*
- *Update of the Regulation on limit values of light pollution*
- *Update of the Traffic Signalling and Road Equipment Policy*
- *Update of recommendations and procedures in DRSI and DARS*
- *Modernization of municipal lighting plans*

- *Adoption of the nationally specific standard SIST EN 13201-1*
- *Proposals for amendments to EN 13201 at European level*
- *Integration of spatial and environmental content into projects*
- *Project-specific audit procedures*
- *Update design education and licensing*
- *Removal of excess lighting*

Responsible: MOP, DRSI, DARS, municipalities

4.1.3. Impacts on Wildlife

Problem description: Light pollution is known to negatively affect living things in various ways. Most often insects, bats, birds, turtles are most exposed in this respect. The problem is extensively treated in the professional literature.

Examples: mass collection and death of insects under lamps, fragmentation of habitats, luminous walls for bats, jamming orientation and premature nesting in birds, jamming orientation in turtles

Solution proposal: Limitation of lighting, appropriate lighting spectrum, prohibition of lighting outside settlements

Measures:

- *Restrictions on lighting setting (spatial legislation and Regulation)*
- *Appropriate spectrum of lamps (Regulation)*
- *Prohibition of outside settlement lighting (Regulation)*
- *Removal of excess lighting*

Responsible: MOP, DRSI, DARS, municipalities

4.1.4. Impacts on People's Health and Well-being

Problem description: Inadequate outdoor lighting affects people's health and well-being on several levels. The most direct impact is the disruption of sleep with light penetrating into dwellings (protected spaces). In this case, the blue spectrum of light that interferes with the production of the hormone melatonin needed for sleep is particularly problematic. People need to help themselves by blocking windows, which is especially absurd in rural areas, where the need for lighting in residential settlements is virtually zero ... On the second level, lighting is becoming increasingly problematic from a traffic-safety perspective, which should help improve it. Due to a number of lighting poles, at least 80 crashes into the lighting poles have been recorded in the last three years, of which several fatal ... The negative impact on the experience of space is greatly underestimated, as we are increasingly landing in completely artificial, banal and anthropocentric environments ... Not least the countless evidently over-dimensioned projects that ruthlessly destroy the environment and space, at many conscious individuals provokes outrage and concern for the future, and the number of complaints is increasing accordingly.

Examples: lighting into protected spaces (dwellings); increasing hazards from a number of lighting poles; ubiquitous systematic and rapidly progressing environmental and spatial degradation with lighting installations

Solution proposal: *A comprehensive and sustainable lighting policy is developed. Direct effects by impacts to protected spaces shall be reduced by sharper requirements and by the use of lamps with a more appropriate spectrum. The number of traffic poles is significantly reduced.*

Measures:

- *Developing a comprehensive and sustainable lighting policy (spatial strategy and spatial legislation, Regulation)*
- *Tightening restrictions on impacts to protected spaces (Regulation)*
- *Appropriate spectrum of lamps (Regulation)*
- *Significant reduction in the number of lamps per lighting object (renovation of DRSI and DARS recommendations, Regulation =?)*
- *Removal of excess lighting*

Responsible: *MOP, municipalities, DRSI, DARS*

4.2.Concrete Examples

4.2.1. Systematic Intensive Illumination of Transit Connections

Problem description: *The lighting of transit connections (regional roads, motorways) is significantly more intensive in Slovenia than in more orderly countries and represents one of the biggest contributors to the degradation of the environment and space with outdoor lighting.* *The intense illumination of transit is the main factor that greatly differs the Slovenian landscape from the landscape in these countries. Too many objects are lighted in too many locations, the objects are illuminated very extensively, high and numerous lamps dominate the landscape.*

Examples: *roundabouts (many lamps, instead of none or max. 4; e.g. Bitnje, Primskovo, Goričane, turning for Kočevska Reka, Krško ... ...), crossings (instead of one or no lamps a whole row), bypasses (e.g. Brnik, Trzin), motorway exits (e.g. Naklo), pavements on regional roads through or outside settlements (e.g. Sveti Duh, villages in Zgornjesavska Dolina, connection Podčetrtek-Dramlje, pavements Horjul-Zaklanec, Gorenja vas-Dolenja Dobrava ... ...)*

Solution proposal: *Abandon lighting outside settlements (regional roads, motorways...). The lighting of individual traffic objects (roundabouts, intersections, sidewalks...) in settlements is rationalized. The illumination of transit roads outside the centres of settlements shall be rationalized and only orienteering illumination is applied.*

Measures:

- *Renovating the starting points for illumination of state roads; omission of SDR 5/2000 recommendations*
- *The measures on the most highlighted concrete cases are addressed in separate points*

Responsible: *MOP, DRSI, DARS*

4.2.2. Peripheral Street Lightning in Rural and Suburban Settlements

Problem description: In addition to over-illuminating transit links, this is the most critical problem. Due to political barriers (opposition of the population) it will be the most difficult to manage. Trends are aimed at illuminating all streets in all settlements, regardless of actual needs and regardless of environmental and space impacts, and there are no restrictions. When one street is lit, expectations follow in everyone else, even if there are only a few houses in them, at greater distances.

Examples: In Poljane near Škofja Loka, in 2000 only the main junctions and the strict centre of the central settlement were illuminated with fewer than 10 lamps. By 2020, the number of lamps has risen to over 100, and the illuminated (vastly excessive and spatially unsuited) is the main wash (cemetery - shop - factory - fire house - cultural centre - village centre - inn - cultural centre - school - factory), whose lighting makes sense with more appropriate lighting. The visibility of the starry sky is already greatly reduced... In perspective, the entire area with a 2 km radius will be systematically illuminated with up to 500 lamps, and thus it will be completely degraded. The side streets are expected to be lit up as well are the links between nearby settlements.

Solution proposal: Continuing trends can only be prevented through a broad environmental policy at national level. On the basis of the estimated number of users (mainly pedestrians) and the exposure of the traffic area, the areas on which illumination is permitted shall be limited. For rural settlements, this means, for example, that only central streets in central settlements and exposed points are illuminated, but no residential streets, paths to remote houses and smaller settlements are illuminated.

Measures:

- *Address the problem in the Slovenia's Spatial Strategy and Spatial Legislation*
- *Update of the Regulation on limit values of light pollution*
- *Definition of restrictions in municipal lighting plans*
- *The need and the possibility to introduce scoring (possible within EN 13201-1) shall be verified, considering additional parameters and excluding illumination below a certain level of needs*
- *National population awareness campaign*
- *Removal of excess lighting*

Responsible: MOP, municipalities

4.2.3. Excessive Lighting Due to the Application of EN 13201

Problem description: Standard EN 13201, which is produced in narrow professional circles, mechanistically prescribes minimal and average surface lighting. For less demanding traffic and safety areas, the recommendations of the standard are completely outside the sustainable framework, and the high uniformity requirements and the minimum lighting make it unacceptable in practicality. Adherence to the standard, which especially due to mechanistic design with the help of computer programs tends to be completely rigid and consistent, leads to unacceptably intense and uniform lighting and to landscape degradation with dense, high and rigid lighting layout. The design by standard is typically misleadingly represented as prescribed by law, and its strict adherence is also required by the State DRSI and DARS, although legally it is only considered a recommendation.

Examples: *intensive lighting of peripheral streets and footpaths (Predmost/Poljane nad Šk. L., the footpath and the bike path in Bonovec near Medvode); the lighting of the roundabout at Krško on the inside because lower lamps have been used; high lamps through the settlements to achieve uniformity of illumination*

Solution proposal: *The standard needs to be critically evaluated in a wider debate at European level. As this requires a longer process, it is necessary to adopt the available measures at national level as soon as possible. Restrictions on the application of the standard shall be laid down in the Regulation. The nationally specific variant of the first part of the standard (EN 13201-1) brings illuminating classes closer to acceptable frameworks, with the need to place with the need to place less laden areas outside the frameworks of the standard also in the standard's terminology, by placing these areas to the class P7, which allows designer's own judgement. This will ensure that the standard is applied only on the busiest traffic areas. Everywhere else (e.g. lighting of peripheral streets in larger settlements) only orienteering lighting is set up or only safety problem points are illuminated. It is necessary to ensure that the standard is also considered in practice only as a recommendation.*

Measures:

- *Definition of the application of the standard in the framework of the Regulation and the national lighting strategy; where the standard, where only the orientation*
- *Adoption of the nationally specific standard SIST EN 13201-1*
- *Verification of the Code of Obligations and, where appropriate, appropriate amendments*
- *Preparation of comments on standard EN 13201-2*

Responsible: *MOP - Spatial Directorate ???, SIST*

4.2.4. Illumination at a Time When There Is No Need

Problem description: *Late-night lighting needs in certain locations fall below the threshold of acceptance for illumination, while in others they are significantly reduced. There may also be changes over the year, e.g. in tourist centres. In certain cases (e.g. a church on the edge of the settlement), lighting is only required for a short period of time.*

Examples: *all lighting in rural settlements except at exposed points (switching off all or most lamps); most regional connections and bypasses (reducing intensity); most lighting in the suburbs (reducing intensity); lighting in tourist resorts, which is only justified during the season; lighted roads to the church at the edge of the settlement*

Solution proposal: *Depending on the location type, recommended switching off after 22.15, mandatory switching off after 23.00, reducing intensity in locations with higher traffic-dependent needs. In locations where lighting is only justified part of the year (e.g. tourist spots in the season), for the rest of the year when the needs are not met at a sufficient level, lighting is completely switched off or its range and intensity is reduced accordingly. In locations where lighting is only required for a short period of time, switching on the sensor or button (if the remaining time on is not desirable).*

WARNING: Switching off and reducing the intensity should not become an excuse to set additional lighting where it is not strictly necessary, as light pollution is at least as problematic in the evening and in the morning, and lamps (poles) are inherently problematic.

Measures:

- *Definition of the requirements for switching off and reducing intensity in the Regulation*
- *Determination of the lighting class in relation to traffic*

Responsible: *MOP, municipalities, DRSI*

4.2.5. Light Above the Horizontal

Problem description: *The underlying problem that creates light pollution of the night sky. The problem is largely contained in Slovenia by replacing lamps after the adoption of the 2007 Regulation.*

Examples: *Residual lighting that does not correspond to ULOR = 0. Individual light sources, e.g. large glass walls of commercial buildings. Private lighting.*

Solution Suggestion: *ULOR = 0 remains prescribed in Regulation. Provision should be made for the replacement of residual lighting which does not comply with the Regulation. The individual light sources causing light pollution shall be limited.*

Measures:

- *Inspection and definitive enforcement of the requirements of the Regulation*
- *Restriction for other LP resources, e.g. private lighting (Regulation)*

Responsible: *MOP, Inspectorate*

4.2.6. Light Spectrum

Problem description: *Both in public lighting and in the lighting of private buildings, LED lamps with a 4000 K light temperature are used, which means a large proportion of blue light. Such a spectrum of light has the strongest impact on animals (e.g. stronger detection of blue light in insects), and is also several times more scattered in the atmosphere, thus causing greater light pollution of the sky.*

Examples: *Until recently the use of 4000 K lamps in most public lighting; most newer lamps for illumination of courtyards have 4000 K or more*

Solution proposal: *Ban the use of lamps with a white-blue light spectrum*

Measures:

- *Prohibition of the use of lamps above 2700 K in public lighting (Regulation)*
- *Use of lamps below 2200 K on less laden surfaces (Regulation)*
- *Regulation of the market for lamps for private use (Regulation?)*

Responsible: *MOP*

4.2.7. Lamp Design

Problem description: *The vast majority of public lighting lamps are industrially designed, on grey confectionery poles, regardless of the location of use. This means that the lamps are landscape-based*

and generally aesthetically unsuited. The compactness of LED technology contributes further to the problem, as the lamps can be very small and thin, and as they are rectangularly planted on the poles, the entire construction is very disproportionate.

Examples: visual degradation of rural areas with confectioner industrial lamps on grey poles; visual devaluation of streets through settlements with clothing lamps on grey poles

Solution proposal: This is a complex and difficult resolution issue that should first be addressed through a proper study by the architectural profession. Recommendations should be defined for individual use cases and for individual types of sites, and these recommendations would then be transferred to the starting points for investors (municipalities, ...). It is possible that the market for designer lamps should be stimulated through measures at national and international level. In addressing this issue, particular attention should be paid to the fact that over-diverse lighting can be even more problematic than the current confectionery.

Measures:

- *Carrying out a study defining approaches to regulating the issue raised*
- *Definition of recommended lamp design (including poles) in municipal lighting plans*
- *Use of black or dark grey poles in rural areas*
- *Participation of (landscape) architects in concrete projects*
- *???*

4.2.8. Height of Poles

Problem description: One of the very pressing, but also practically entirely unsolved problems with the lighting, is the domination of lamps in the space, rather than being as little as possible visible infrastructure. This is particularly the case with the high height of poles, which makes it easier for designers to meet the recommendations of EN 13201.

Examples: at least 8 m high lamps on main roads through settlements, regardless of the type of settlement; often at least 6 m high lamps in side streets; at least 8 m high lamps around roundabouts and intersections; increasingly at least 8 m high lamps for illuminating pavements between settlements ...

Solution proposal: Regulating this problem is challenging and requires a broader multidisciplinary approach that will also consider the effects of lighting on the space and will go beyond current one-dimensional technical approaches. For individual types of layout, optimal solutions must be found to reduce the height of the lamps as much as possible or to adapt to locations.

Measures:

- *Make optimal recommendations for individual site types that consider the spatial aspects*
- *Limit of illumination uniformity below a factor of 0,4 (Regulation)*
- *Failure to use EN 13201 on less congested areas*
- *Adoption of the nationally specific standard SIST EN 13201-1*
- *Proposals for amendments to EN 13201 at European level*

Responsible: *MOP - Spatial Directorate, SIST, DRSI, DARS, municipalities*

4.2.9. High Poles along Transit Connections Through Villages

Problem description: *One of the most difficult issues related to lighting is the question of how to avoid systematic degradation of settlements with high poles along the main roads through settlements. On such roads, lighting makes sense in most cases, but implementation represents strong environmental and spatial degradation. Such lighting installations are due to the fact that practically always the entire surface of the road is illuminated, not just the pavement. In many cases, it would probably be sufficient to illuminate the pavement, which is also not needed to be illuminated by the standard. In addition, the decisions to illuminate the whole road, are often invoked by the standard EN 13201-1, which, by the very absence of explicit recommendation/permission that only pavement can be illuminated, leads to such decisions.*

Examples: *Most settlements in Slovenia; The class 3 regional road in Poljane above Škofja Loka (the main street in the settlement, perpendicular to class 2 regional road through the Poljanska valley) is medium-laden, but on the stretch through the settlement traffic is tempered by the usual speed limit and additionally with the speed bump. The section is illuminated all over the surface of the road with 8 m high industrial lamps at a distance of about 30 m. Such lighting is spatially inadequate, with an inappropriate luminous and aesthetic influence, disrupting residents and putting a heavy burden on the entire area. After 9 PM, only every third lamp lights up, and the lighting is still sufficient for walking and orientation. After 22.15 PM, the lighting is completely switched off; Regional 1st class road through settlements between Škofja Loka and Kranj (4-5 km continuous lighting; potentially 10 km when/if the entire section is illuminated through the settlement Bitnje). Lighting is required at least in the section from Škofja Loka to Dorfarje, and the implementation with 9 m high lamps strongly degrades the appearance of settlements and luminously pollutes the surrounding area.*

Solution proposal: *A wider debate is needed, involving the (landscape) architectural profession in addition to lighting experts. Solutions must go in the direction of illumination only of pavements and (also with the help of this) a significant reduction in the height of lamps. In Austria, similar sections are illuminated with 5 m high lamps at a distance of at least 50 m high.*

Measures:

- *Preparation of concrete solutions that consider both safety and spatial and environmental aspects*
- *Update of recommendations for DRSI and municipalities*
- *Limit the uniformity of lighting in the Regulation (< 0.2 outside the centers of settlements?)?*
- *Adoption of the nationally specific standard SIST EN 13201-1, where the question of when pavement-only illumination is recommended can be explicitly processed*
- *Where spatially possible and at the same time does not constitute too much interference with agricultural land, footpaths shall be built separately from the road. In such cases, the footpaths are illuminated more rationally, preferably only orienteering or where possible they may not be illuminated at all.*

Responsible: *MOP (Spatial and Environmental Directorate), DRSI, SIST*

4.2.10. Lighting the Whole Road or just the Sidewalk?

Problem description: In certain cases where the whole road is illuminated according to EN 13201 (M classes), only the pavement lighting would be sufficient. In addition to increased light pollution, the consequence of illuminating the whole road are also high and densely placed lamps, which greatly degrade the appearance of settlements.

Examples: pavements outside the centres of settlements along regional roads, sidewalks along municipal roads in the centres of settlements (e.g. central street along the municipal road in Poljane near Škofja Loka)

Solution proposal: Where feasible, a separate footpath is built. For pavements that contact the road, it shall be determined in which cases only the pavement shall be illuminated. As a rule, this approach is used for all pavements outside the towns and centers of rural settlements. SIST EN 13201-1 should explicitly state that in cases where the pavement is contacting the road, it is not necessary to illuminate the whole road in classes M, but it's possible to illuminate only the pavement by class P under determined conditions.

Measures:

- *Update of recommendations for DRSI and municipalities*
- *Adoption of the nationally specific standard SIST EN 13201-1, where the question of when pavement-only illumination can be explicitly processed*

Responsible: MOP - Spatial Directorate, SIST, DRSI, municipalities

4.2.11. Urbanization of Rural Areas by Linear Layout of Lamps

Problem description: The steady linear layout of lamps generated by the requirements of EN 13201 outside cities represents one of the most pronounced elements of urbanization in itself and is, for example, inappropriate and unnecessary for most rural areas.

Examples: steady linear placement of lamps in lateral rural streets, on footpaths, on connections between settlements ...

Solution proposal: Most of the problem is solved by abandoning lighting outside settlements and in peripheral parts of rural settlements, which is a necessary measure both in terms of the prevention of light pollution and in terms of inadequate urbanization. The remaining sections, except the most laden ones, shall be illuminated only for orientation, with large spacing between the lamps or by the positioning of the lamps at the exposed points, and the height of the lamps shall not, as a general rule, exceed 5 m.

Measures:

- *Restriction of rural illumination by Regulation and spatial legislation*
- *Omission of use of EN 13201 in most rural areas and suburbs; by placing such sections into class P7 or with an additional national specific class*

Responsible: MOP (Spatial and Environmental Directorate), SIST, municipalities

4.2.12. Intensity and Uniformity of Lighting in Peripheral Parts of Settlements

Problem description: In peripheral parts of settlements where the need for lighting intensity and uniformity is very low, the requirements of EN 13201 illuminate strongly and evenly. The consequences are light pollution and urbanization with a dense linear layout of lamps.

Examples: residential streets in the suburbs; residential streets in the central parts of rural settlements; peripheral streets in rural areas (at today's state of illumination, otherwise this should not be illuminated at all)

Proposal for a solution: Most of the problem is solved by abandoning lighting in peripheral parts of settlements, which is a necessary measure both in terms of the prevention of light pollution and in terms of inadequate urbanization. The roads and streets which are illuminated anyway, shall be illuminated only for orientation, with the setting of lamps at greater distances (80-100 m, modelled on neighbouring Austria) or at the exposed points, and the height of the lamps shall not normally exceed 5 m. It is desirable that the spacing between the lamps is not even, but only the exposed points are illuminated.

Measures:

- *Restrictions in the Regulation*
- *Instructions to municipalities*
- *Nationally specific standard SIST EN 13201-1, which classifies most such sites in class P7 or lowers the intensity requirements for the remaining locations and, in particular, lowers the uniformity of lighting. Op.: Only by amending EN 13201-1, the problem is unlikely to be fully contained (e.g. uniformity of lighting), so also amendments to EN 13201-2 at European level are necessary, as according the available interpretations this part of the standard is not under the national responsibility.*

Responsible: MOP, SIST, municipalities

4.2.13. Number and Height of Lamps at Roundabouts

Problem description: The illumination of roundabouts, especially outside or at their edge, represents one of the most aggressive and at first sight inappropriate and unnecessary interventions in the space, and the lighting mode in Slovenia deviates extremely from approaches in orderly countries. Typically, 12-25 high-rise lamps are installed on roundabouts and their connection roads, such completely dominating the space.

Recent examples: Stražišče near Kranj, exit for Kočevska Reka on regional road Kočevje - Brod na Kolpi, Goričane near Medvode ...

Solution proposal: Roundabouts are illuminated only by 4 lamps on entrances, or pedestrian crossings. The height of the lamps shall, as a general rule, be limited to a maximum of 6 m. Outside settlements, the roundabouts are not illuminated. Lighting must not be used at roundabouts without pedestrian crossings.

Measures:

- *The problem is explicitly (in a wider set) addressed in the Regulation and/or spatial legislation*
- *Prohibition of lighting outside settlements (Regulation)*
- *Implement the solution template in DRSI design requirements*

Responsible: MOP, DRSI

4.2.14. Number and Height of Lamps at Intersections

Problem description: Unlike neighbouring Austria, Slovenian intersections, including those outside settlements, are illuminated by numerous lamps, and parts of connected roads are illuminated as well. The lighting of the intersection outside or near the settlement often represents the dominant in the space, and due to the number of such locations this is one of the main degradation contributions with lighting installations.

Examples: 8 lamps on a total distance of 200 m on a simple exit in Poljane above Škofja Loka; most newer crossings in Slovenia have a high number of lamps

Solution proposal: The ban on lighting outside settlements is also applied to intersections. Where necessary, no more than one lamp shall be placed at the intersection, as is the practice in Austria. At junctions in settlements, only the junction without access lanes and export lanes shall be illuminated with as few lamps as possible. ??No lighting may be installed at junctions with traffic lights without pedestrian crossings.

Measures:

- *The problem is explicitly (in a wider set) addressed in the Regulation and/or spatial legislation*
- *Prohibition of lighting outside settlements (Regulation)*
- *More rational recommendations for illuminating intersections*

Responsible: MOP, DRSI, municipalities, SDR

4.2.15. Sidewalks along Connections Between Settlements

Problem description: In the absence of restrictions and with a technicistic approach to mandatory pavement lighting, regardless of location, the lighting of pavements between settlements is becoming increasingly common. With scattered settlements and relatively short settlement spacing, there are already cases where the pavements are continuously illuminated at a distance of almost 10 km, and the continuation of trends leads to continuous illumination at distances of tens of kilometers or to continuous grid lighting of entire regions. This is one of the most extreme exceedances of environmentally and landscapely acceptable boundaries with catastrophic cumulative impacts.

In most cases, the problem is further emphasized by the interpretation of the requirements of standard EN 13201-1 by the designers, who choose to illuminate the whole road and not just the pavements. Which is achieved with at least 8 m high lamps placed along the roads, also through fields and meadows.

Examples: *6.5 km continuous illumination from Podčetrtek in the direction of Dramlje, with the potential for continuous illumination within a distance of 32 km only on the section to the highway; intensely lit surroundings of Novo Mesto; 1 km of illuminated pavement between Horjul and Zaklanec; 0.7 km of illuminated pavement between Gorenja vas and Dolenja Dobrava; 400 m of 10 m high lamps on an uninhabited section in village Jagnjenica*

Solution proposal: *Lighting outside settlements is prohibited.*

Measures:

- *Prohibition of lighting outside settlements in the Regulation*
- *Instructions to DRSI and municipalities*
- *In locations where illumination is necessary (outside settlements should normally not be allowed!), only the pavement shall be illuminated in the orientation lighting and not the whole road according to the standard. This can be achieved in part by amending SIST EN 13201-1, where it has to be clearly stated that only the pavement can be illuminated (meant mainly for settlements – see the corresponding example)*

Responsible: *MOP, DRSI, municipalities, SIST*

4.2.16. Sidewalks along Main Roads Outside the Centres of Settlements (not applicable to major entrances into larger urban settlements)

Problem description: *The problem is attached to the previous point (sidewalks between settlements) and also contributes very strongly to the negative effects of lighting. Since the settlement is very dispersed in Slovenia, and even the pavements outside the centres of settlements along the main roads are illuminated according to the standard, there are very long continuous lines of intensive lighting.*

Examples: *examples throughout Slovenia; illuminated pavements through scattered settlements from Podčetrtek to Dramlje; partially already installed potential continuous lighting in the central part of the Poljane valley at a distance of 7 km and four side valleys at a distance of at least 2 km*

Solution proposal: *Sidewalks are continuously only illuminated in central parts of settlements with concentrated settlement and higher pedestrian density. In peripheral parts of settlements, pavements are not illuminated or are illuminated only for orientation (only along main roads), with a distance between lamps of at least 80-100 m and their height not exceeding 5 m. (? It is desirable that the lamp spacing is not even.)*

Measures:

- *Restrictions in the Regulation*
- *DRSI instructions and municipalities*
- *Amendment of SIST EN 13201-1*

Responsible: *MOP, DRSI, municipalities, SIST*

4.2.17. Bypasses

Problem description: Due to length, lighting intensity, height of lamps ... the bypass lighting represents one of the most extreme interventions in the environment with outdoor lighting. At the same time, these are mostly unnecessary interventions, as motor vehicles have their own headlights and there are no cyclists and pedestrians on these surfaces.

Examples: Ljubljana airport bypass (very long lighting for motor vehicles only), Grobelno bypass (very long lighting with high lamps past a small settlement), Poljanska valley bypass in Škofja Loka (questionable length and intensity), Gorenja vas bypass (unnecessary light load on the village)

Solution proposal: As a rule, bypasses are not lighted. Explicitly identify which bypasses need to be illuminated anyway (e.g. heavily loaded sections of bypasses within cities)

Measures:

- *More appropriate recommendations shall be made for the illumination of bypasses*
- *The limitation of the lighting of bypasses shall be defined in the Regulation*

Responsible: MOP, DRSI, DARS

4.2.18. Highway Connections and Splits

Problem description: The lighting of highway connections and junctions is typically carried out with extensive lighting installations and contributes greatly to light pollution and landscape urbanization. In countries that do not illuminate highways (Germany, France, Austria, Hungary, Czech Republic, Slovakia, (not entirely) Spain …), the space works significantly better.

Examples: Export Naklo, Novo Mesto, ...

Solution proposal: Highway connections and junctions are not illuminated.

Measures:

- *The lighting of highway exits, entrances and splits shall be suspended*
- *Turn off and remove the existing lighting*

Responsible: DARS, MOP

4.2.19. Entrances and Exits of Highway Rest Areas

Problem description: Highway rest areas are also extensively illuminated on imports and exits. The lighting on the exits bothers drivers, because the car that connects from the staging area is more noticeable when it comes out of darkness, its lights can be seen better on a dark background. At the same time, when driving past the area, it is not necessary to adapt the eyes to a sudden bright light.

Examples: motorway staging area at Radovljica

Solution proposal: In line with the approaches in Germany, Austria, etc., the entrances and exits of highway staging points are not illuminated.

Measures:

- *Restriction in the Regulation?*
- *Omission of illumination of entrances and exits in DARS recommendations*

Responsible: *DARS, MOP*

4.2.20. Footpaths and Bike Paths

Problem description: *With omnipresent lighting, also footpaths and cycle paths between settlements and sparsely populated parts of settlements are lighted, which can lead to very long lines of lighting.*

Examples: *Bonovec near Medvode*

Solution proposal: *The lighting of footpaths and cycle paths is capped at maximum by prohibiting lighting outside settlements and by streamlining lighting in sparsely populated parts of settlements. Exceptionally, in these cases, on shorter sections, lighting is permitted in the case of very high traffic by pedestrians or cyclists (e.g. tourist areas during the season).*

Measures:

- *Prohibition of lighting outside settlements in the Regulation.*
- *Streamlining of lighting within settlements with provisions in the Regulation. No lighting or orientation lighting in parts of settlements with low traffic of pedestrians and cyclists.*

Responsible: *MOP, municipalities, DRSI*

4.2.21. Number and Height of Lamps at Bus Stops

Problem description: *Bus stations are illuminated with a large number of typically 8-9 m high lamps.*

Examples: *Most newer bus stations along regional and municipal roads*

Solution proposal: *Modelled on neighbouring Austria, smaller bus stations are illuminated with a single lamp, with a recommended height of 5 m. In late-night hours when there is no bus traffic, the lighting is off.*

Measures:

- *The problem is explicitly (in a wider set) addressed in the Regulation and/or spatial*
- *Recommendations for rational lighting of bus stations*

Responsible: *MOP, DRSI, municipalities*

4.2.22. Number and Height of Lamps in Car Parks

Problem description: *Lighting of larger car parks (especially exposed example are the parking lots in front of shopping centres) is very prominent in terms of number, height and density of lamps. Due to the strict adherence to the recommendations of EN 13201, the lighting of all other car parks and rest areas is also very intensive.*

Examples: *parking lots in front of shopping centres; larger car parks on the main city entrance roads; imposing intensive lighting on the small staging points along the regional road at the edge of the Planina lake Regional Park*

Solution proposal: *Parking lighting does not consider EN 13201. Small parking spaces with low traffic are illuminated by sensor lighting and the number of lamps on them is minimal, for orientation only. Also, larger car parks are lighted with sensor lighting of a limited number of lamps outside peak load time. The lighting of the parking lots of shopping centres is shut down outside the operating time.*

Measures:

- *Limitations in Intensity and time of illumination (Regulation)*

Responsible: *MOP, municipalities, DRSI, DARS?*

4.2.23. Bridges

Description of the problem: *In some places, even outside settlements, bridges are illuminated with a large number of lamps according to the standard or are, within settlements, intensely illuminated according to the standard, regardless of location*

Examples: *closure of the Poljanska valley bypass at Zminec above Škofja Loka – bridge, turn-off towards the village and roundabout are illuminated together with almost 40 lamps; bridges in small towns (e.g. Krško)*

Solution proposal: *bridges outside settlements are not illuminated; bridges with low density of pedestrians and traffic in settlements are illuminated orientationally, without complying with EN 13201*

Measures:

- *Prohibition of lighting outside settlements in the Regulation*
- *Address the problem in design recommendations and municipal lighting strategies*

Responsible: *MOP, DRSI, municipalities*

4.2.24. Pedestrian Crossings

Problem description: *Pedestrian crossings are often illuminated with flashing lights that shine all night. Flashing lights are a distraction for the surrounding residents, but in the late night they are not required due to virtually zero traffic.*

Examples: *residents at the main junction in Poljane above Škofja Loka are even more distracted by flashing lights above the pedestrian crossing than by public lighting lamps*

Solution proposal: *During the hours of minimal pedestrian traffic, flashing traffic lights are turned off. If possible, flashing traffic lights are replaced by different solutions.*

Measures:

- *Where possible, different solutions shall be used*

- *The time of shutting down flashing traffic lights for different types of locations has to be prescribed in the Regulation*

Responsible: MOP, AVP, DRSI

4.2.25. Elevated and Illuminated Traffic Islands

Problem description: Elevated traffic islands, which are life-threatening for drivers, constitute a reason or excuse for lighting, often intensely and extensively.

Examples: A transport island is built on the exit from the regional road at the school in Poljane above Škofja Loka, which in itself poses a danger to traffic behind a partially opaque mild bend. The exit is illuminated at a distance of 200 m, with 8 consecutive lamps of a height of 8-9 m; intensive lighting of traffic islands at the beginning of the Vrhnika slope; intensive and extensive lighting of the main incursion to Bled

Solution proposal: Avoiding solutions with transport islands. Following the example of neighbouring Austria, if really needed, islands are built on the level of the road surface, which is also more acceptable from the view of landscape preservation acceptable. In cases where islands are still built (raised or levelled), only the immediate island should be visibly marked (preferably without lamps) and lighting shall not be installed.

Measures:

- *Guidelines for the construction of transport islands on DRSI*

Responsible: DRSI

4.2.26. Shop Windows and Walls

Problem description: Shop windows and walls represent large radiant areas and are mostly lit all night. In some cases, the entire walls of the buildings are untied.

Examples: Hofer, Spar stores …

Solution proposal: Window illumination shutting down after a certain hour is prescribed. Additional restrictions on the permitted area of untied walls should be considered.

Measures:

- *Check the provisions of the Regulation concerning the permitted surface area of untied walls and, if necessary, sharpen them.*

Responsible: MOP

4.2.27. Illuminated Signs of Shops and Business Facilities

Problem description: The illuminated inscriptions of shops and business buildings represent large and strong radiant areas.

Examples: *large signs of shopping centres; the inscription of a small Mercator shop in Šiška disrupts the sleeping of a resident in a nearby street; the inscription of a small shop in Gorenja vas shines a bright light on the entire village above the shop*

Solution proposal: *Limit size, luminance, allowed locations, running time*

Measures:

- *Restrictions in the Regulation*

Responsible: *MOP*

4.2.28. Limiting Lighting Intrusion into Protected premises

Problem description: *The illumination of protected premises (definition = ?) is limited by the existing regulation, but the permitted values are too high. People are already complaining at 1,000 times lower lighting levels.*

Examples: *lighting in the bedroom by the shop inscription; intrusive illumination of private premises by stadium illumination*

Solution proposal: *The problem is difficult to solve because already very low values are disturbing, and in the urban environment the intrusion of artificial light cannot be completely avoided. The values laid down in the existing Regulation should be reduced as a maximum. For individual main sources of interference (e.g. public lighting, store inscriptions...), appropriate conditions (permitted operating sites and hours, light-technical characteristics, layout methods) shall be prescribed.*

Measures:

- *Reduction of permitted levels (Regulation)*
- *Setting technical limits for advertising lighting surfaces (Regulation)?*
- *Recommendations for the design of public lighting?*

Responsible: *MOP*

4.2.29. Christmas and New Year Lighting

Problem description: *The Christmas-New Year lighting period is being prolonged year by year and its volume is increasing. Thanks to the new LED technology, which allows for greater luminance with smaller powers and greater flexibility in design and affordability, festive lighting has become more affordable in quantity. The settlements are turning into Disneylands with extensive flashing lighting.*

Examples: *early dates of the start of lighting of shops and town centres; a village house around which five trees and a façade are illuminated; a 10-m-long chain on the façade, with bright blue light flashing intrusively throughout the night.*

Solution proposal: *Specify the lighting parameters that can be used (maximum luminosity of the lamps available for free sale, total quantity per private building, total quantity per public location, flashing). The period during which lighting is permitted shall be limited.*

Measures:

- *Limit the period during which lighting is permitted (Regulation)*
- *Lighting parameters for the mass market products shall be prescribed (Regulation)*
- *Municipal ordinances prescribe the permissible type and extent of lighting*

Responsible: MOP, municipalities

4.2.30. Lamps in Front of Private Buildings (Lighting Market Regulation)

Problem description: For lighting in front of private buildings, white-blue light-spectrum lamps are mainly available on the market, which are in many cases very strong due to technological and consequently price affordability.

Examples: powerful wall lamps/reflectors for illuminating courtyards with white-blue spectrum and range of more than 100 m

Solution proposal: Limit what external lamps for private use are allowed to be sold and used in Slovenia. Limit the spectrum of light and the power of lamps, except special purpose lamps. 0 % lighting above the horizontal is prescribed also for private lighting.

Measures:

- *The Regulation shall specify the spectrum (below 2700 K), the maximum power (???) and the condition 0 % above the horizontal*
- *Limitation of long duration lighting, except in the case of direct use*

Responsible: MOP

4.2.31. Personal Lamps/Flashlights for Outdoor Use (Lighting Market Regulation)

Problem description: Very powerful battery lamps/flashlights for personal use appear on the market (e.g. range 500 m). Such lamps can be disruptive for both animals and humans.

Examples: Feizer's aggressive campaign

Solution proposal: Limit the spectrum of light and the power of lamps, except special purpose lamps.

Measures:

- *The Regulation shall specify the spectrum (below 3000 K) and the maximum power (???) of personal lamps for outdoor use*

Responsible: MOP

4.2.32. Sports Facilities

Problem description: The lighting of sports facilities is addressed in the existing Regulation. In many cases, there are still strong environmental impacts, so it is necessary to review the provisions of the Regulation and the effectiveness of controls and, if necessary, to put in place added restrictions. In winter, in the long term, small ski and cross-country centres can become a particular problem, which, using artificial snowfall technology, can become very numerous over time and their impact is relatively large during the period of operation.

Examples: jamming of protected premises around sports stadiums; very strong spotlights on a village sports field, oriented at a certain angle, brightly illuminate the surroundings over a distance of more than a km; planned construction of new cross-country and ski centres with artificial snow

Solution proposal: Brightness on smaller surfaces according to expert recommendations. Mandatory limit of 0 % lighting above the horizontal. For outdoor sports facilities of a larger scale (e.g. ski slopes, cross-country ski trails), rational restrictions on illumination and operating time. Spatial planning policy prescribes what number of such facilities are permissible.

Measures:

- *The limit of 0 % of the flux above the horizontal is applied sharply (Regulation)*
- *Restrictions on the illumination of large area outdoor sports facilities? (Regulation)*
- *Limitations on the number and location of large area external sports facilities (spatial strategy)*

Responsible: MOP

4.2.33. Cultural Monuments

Problem description: The illumination of cultural monuments is addressed in the existing Regulation. The regulation is largely appropriate, but it is necessary to limit the lighting in the late-night hours.

Measures:

- *The Regulation adds that monuments may be illuminated from dusk until 22.00 pm, or until 24.00 pm at the latest in tourist resorts.*

Responsible: MOP

4.2.34. Business Facilities and Institutions

Problem description: The problem of illumination of business facilities and institutions is addressed in the existing Regulation. Due to more efficient light sources, restrictions are no longer appropriate.

Solution proposal: The concept of limitation remains the same, the maximum permissible power in W/m2 is reduced due to more efficient light sources. This is the only way to control lighting at a distance, as you can't scan private land with an illumination meter without the owner's permission. The concept of power per square meter of floor area is simpler for the inspector.

Responsible: MOP

4.2.35. Facades of Private Buildings

Problem description: Under the current regulation, illumination of the facades of private buildings is permitted up to 200 m from the nearest public lighting. With the increasing prevalence of public lighting, this means practically throughout the country, further contributing to light pollution and urbanization. The same as with the proliferation of public lighting, also this problem can have very large cumulative effects, at least on the appearance of space, but also on the environment.

Examples: In a rural area, about 200 m from a lighted bridge in an unlit settlement, the façade of one of the houses is illuminated. Despite the weak lighting in the dark night, the house glows, stands out strongly from the background and represents a distraction. As anyone else will follow in the long term, even without public lighting, the rural settlement will turn into a floodlit area.

Solution proposal: In settlements below a certain number of inhabitants (approx. 2,000), the lighting of facades is completely prohibited. Consideration should be given to the possibility of a general ban on illumination, including in cities, other than the facades of cultural monuments.

Measures:

- *Prohibition of façade lighting in settlements below 2,000 inhabitants or everywhere except cultural heritage facilities (Regulation)*

Responsible: MOP

4.2.36. Removal of Redundant and Inappropriate Lighting

Problem description: Since Slovenia is already highly degraded by outdoor lighting installations and many of the projects are exaggerated, after the adoption of the amended Regulation, provision will be made for the removal of part of the lighting or for its alignment with the Regulation.

Examples: rationalization of exaggerated projects on regional roads (roundabouts, intersections, bypasses, pavements...); streamlining lighting in settlements

Solution proposal: The pace of alignment with the requirements of the amended Regulation and spatial legislation is determined. Shorter deadlines shall be set for the easily feasible interventions (e.g. removal of excess lighting) and interventions requiring additional investment (e.g. replacement of lamps with an inappropriate spectrum) shall be carried out over time.

Measures:

- *The Regulation sets time limits for the compliance*
- *Operators shall draw up an inventory of lighting that does not comply with the Regulation and the spatial strategy*
- *Raising awareness of the population*

Responsible: MOP, DRSI, DARS, municipalities

4.3.Organizational Aspects

4.3.1. Municipal Lighting Plans

Problem description: Under the existing Regulation, municipalities must have a lighting plan in place. The obligation is only partially implemented and the quality of the plans is questionable. Substantive plans do not address environmental and spatial aspects.

Solution proposal: The quality of municipal lighting plans is raised by taking greater account of environmental and spatial aspects. The plans must assess the cumulative situation, if the municipality area is fully illuminated in the selected way. The obligation to inventory lighting may be transferred to a single lamp cadastre on the country level.

Measures:

- *A sample example of the municipal plan shall be prepared*
- *Request for the introduction of a cadastre in the Regulation*
- *Creating an online platform*

Responsible: MOP, municipalities

4.3.2. Central Cadastre of Lamps for the Whole Country

Problem description: In order to manage the problem, an overview of the actual situation on the ground and of the trends of lighting expansion is required.

Examples: monitoring of the situation in individual areas according to the provisions of the Regulation; monitoring of trends; assessments of cumulative impacts

Solution proposal: A central lamp cadastre is introduced for the whole country. The cadastre must be public on the web platform so that anyone can check the location of the lamp, the lamp model, the power, the colour temperature, the lamp size, the date of installation of the lamp and the traceability to the old lamps at this place. Appropriate analytical tools shall also be produced to enable different representations.

Measures:

- *Request for the introduction of a cadastre in the*
- *Creating an online platform*
- *MOP's obligation to carry out monitoring in the Regulation*

Responsible: MOP, municipalities, DRSI, DARS

4.3.3. Designer skills

Problem description: It is occasionally highlighted that the designers are not adequately trained and therefore there are deviations in the projects. In practice, there are few such cases, and the designers adhere to the standard, so that competence does not pose a major problem from a technical point of view, but the problem is that the designers do not consider the wider context.

Examples: *design of 8 m high lamps along a rural road across a field, because this is recommended in the standard EN 13201 - the designer should be able to assess that it is more appropriate to illuminate for pedestrians only with lower lamps (under current approaches, but otherwise illumination should no longer be allowed in a specific case because it is a road outside settlements);*

Solution proposal: *Designer training on topics that go beyond the bare technical design, especially on environmental and spatial influences.*

Measures:

- *Following the adoption of the amended Regulation and the spatial lighting strategy, issuing of written recommendations and organisation of appropriate trainings*
- *More integration of environmental and spatial content into professional communication and professional meetings (e.g. SDR)*
- *Accreditations for designers ???*

Responsible: *Faculty of Electrical Engineering, SDR, MZI*

4.3.4. Assessment and Consideration of Environmental Impacts in Individual Projects

Problem description: *Concrete lighting projects must also be assessed in terms of environmental impacts. In general, environmental impacts are addressed by the Regulation, but it is not effective. For certain locations, it's probably already required to get approvals?*

Examples: *the most pronounced problem is the failure to consider cumulative impacts - without thinking about what the final situation will be, project after project will be implemented*

Solution proposal: *In general, this aspect should be addressed through the amended Regulation and the spatial lighting strategy and individual projects should only be assessed in specific locations.*

Measures:

- *Limitation of lighting locations and cumulative impacts in the Regulation*
- *Spatial lighting strategy*
- *Assessment of cumulative impacts in municipal plans*

Responsible: *MOP, municipalities*

4.3.5. Assessment and Consideration of Spatial Impacts in Individual Projects

Problem description: *One of the key problems with the installation of lighting is that spatial impacts are not assessed.* *Lighting is considered to be part of road infrastructure and is based on technical recommendations, not full spatial planning. Consequently, lighting represents a very noticeable alien element in the space, even where it could be placed unobtrusively or could even represent an aesthetic improvement of the space.*

Examples: *high-luminous lamps dominate the settlements and landscape; straight lines of lamps in the countryside urbanize the landscape; uniformed grey poles and industrially shaped lamps, regardless of location*

Proposal for a solution: *Unlike environmental impacts, which can mainly be addressed overarchingly by legislation and orientations at national and local level, spatial placement should be assessed on a project-by-project basis. While, of course, appropriate overarching strategies at national and local level are also needed to cover this aspect.*

Measures:

- *For the national and local level, lighting strategies are developed, including the mentioned aspects, e.g. the principles of the placing of lamps, the recommended type of lamps, the recommended design, the colour, the height of the pillars ...*
- *Experts with landscape architectural and urban planning skills shall be included in the projects*

Responsible: *MOP - Spatial Directorate, municipalities, ???*

4.3.6. Inspection

Problem description: *Inspection is an important part of the problem management system, but in the case of complaints, inspectors are not effective, in large part because they do not have a foothold in the legislation or because there are no accredited measurement experts required by the Regulation.*

Examples: *a legitimate complaint by a citizen about the lighting of the store's light inscription into the bedroom, which was referred to the inspectorate by an MOP representative, which under the law had no basis for action.*

Solution proposal: *Tightening the lighting conditions and simplifying the conditions for measurements accreditation in the Regulation.*

Responsible: *MOP*

4.3.7. Discharge of the Lighting Operator's Liability

Problem description: *The outbreak of large-scale light pollution is largely due to intimidation by lighting vendors and designers who sell large quantities of lighting under the pretext of avoiding potential accidents lawsuits by the buyer (municipality or state).* *In municipalities, then, frightened buyers opt for excessive projects produced in accordance with the non-binding European standard EN 13201, even when it is quite obvious that the projects thus produced do not meet the needs.*

Examples: *Opinions of the representatives of municipalities that they will have to pay compensation, if there is an injury because of improper illuminated within settlements or on unlit pavements on the links between settlements; absurd and environmentally and spatially extremely invasive lighting projects due to strict adherence to the recommendations of the standard; strict and in some places, evidently absurd lighting because of compliance with the recommendations of the standard on traffic areas under the jurisdiction of DRSI*

Solution proposal: *Lighting operators are adequately relieved of their responsibilities. Lighting should be merely a privilege, not an obligation, except at the most exposed points, which need to be specified.*

Measures:

- *The legislation shall be checked and, if necessary, the responsibility of lighting operatoers shall be adequately relieved. If this is already properly defined by existing legislation, the problem is explicitly addressed in lower-level documents, e.g. in state strategy and municipal lighting plans. In any case, the possibility of explicitly addressing this problem in the Regulation shall be verified.*
- *A clear definition that the standard is non-binding in Regulation ???*
- *Rational demarcation between security ensuring and comfort lighting (explicitly addressed in the Regulation?) ???*

Responsible: *MOP, Ministry of Justice*

4.3.8. Fines for Lighting Operators and Designers

Problem description: *In certain cases, lighting (e.g. total per capita consumption) deviates from the provisions of the Regulation or is designed well above the level of needs, including according to the recommendations of EN 13201.*

Examples: *municipality exceeds per capita consumption; footpath illumination exceeds standard recommendation*

Solution proposal: *Time limits for alignment of lighting status with the Regulation and corresponding fines in the event of non-compliance are set. Clear criteria shall be laid down as to what frameworks lighting is permitted and what tolerances are allowed (e.g. up to 30 % tolerance at sites where it is designed to the standard). Fines shall be imposed for major derogations.*

Measures:

- *Reasonable fines shall be fixed for non-compliance with the provisions of the Regulation. Fines must be appropriately high so that inspectors can impose them, while at the same time having the expected effect.*
- *The criteria and tolerance for the lighting design are set ???*

Responsible: *MOP, Inspectorate, municipalities*

4.3.9. Control Over the Use of Investment Assets

Problem description: *The funds available for projects, in particular European Union and Ministry for infrastructure budget funds, as well as the available municipal finances, are one of the main generators of the problem, as they encourage investment, and investors and contractors are motivated to maximise their spending. In the absence of an appropriate spatial and environmental policy, the technical, bureaucratic and business aspects of project implementation completely dominate.*

Examples: *the scale of projects on regional roads*

Solution proposal: Based on the elaborate lighting strategy in the framework of Slovenia's spatial and environmental policy, the amount of needed resources is assessed and the available resources are limited accordingly. Stricter (external) control of investments in lighting in individual projects is introduced.

Measures:

- *Streamlining lighting in the framework of Slovenia's spatial and environmental policy and the resulting rationalisation of municipal lighting strategies*
- *Limit of the amount of permitted investments???*
- *Involvement of the Court of Audits in the control of the use of lighting resources*

Responsible: MOP, DRSI, DARS, municipalities, Court of Auditors

4.3.10. Monitoring of the Process of Alignment with the New Regulation

Problem description: After the adoption of the amended Regulation, it will be necessary to align the state of lighting with the new regulations (removal and replacement of inadequate lighting). Given that this is a large-scale process, it will be necessary to assign a process administrator.

Actions: The MOP shall monitor the implementation of measures to bring the situation into line with the Regulation and prepare annual reports in this regard.

Responsible: MOP

4.3.11. Annual Meetings with Environmentalists and Other Experts on the Negative Effects of Light Pollution

Problem description: In recent years, light pollution environmentalists, who are the main knowledge bearers of both the problem status in the country and in the world, as well as of the theory of problem management, have not had access to the MOP, and their warnings and proposals have been largely ignored or eliminated by formalistic arguments, without real action. The MOP itself does not have sufficient knowledge of this issue.

Measures: In particular, due to the current very bad situation in the country, annual meetings are held, to which representatives of environmental organisations in this field are invited. The meetings aim at an overview of the situation and the preparation of proposals for further measures.

Responsible: MOP

Abbreviations:

- *MOP Ministry of the Environment and Spatial Planning*
- *DARS Directorate for Motorways of the Republic of Slovenia*
- *DRSI Directorate of the Republic of Slovenia for Infrastructure*
- *MJU Ministry of Public Administration*
- *MZI Ministry of Infrastructure*
- *SDR Slovenian Lighting Society*
- *SIST Slovenian standardization organization*
- *AVP Traffic Safety Agency*

Related documents:

- *Vision and proposal for an external illumination strategy with a view to protecting the night environment (H. Mikuž, A. Mohar, T. Trilar, T. Zwitter, M. Zagmajster; March 2020)*
- *Degradation of the natural environment and landscape with road/street lighting, problem overview and solution proposals (A. Šubic; November 2019)*
- *Light Pollution Is Not the Complete Name of the Problem (A. Šubic; May 2019)*