

Annex 2 – Limit values by lighting zone (MZ0–MZ4)

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Ceilings, not targets
Before / during the deep night

How to use this annex. Find the zone of the place in Chapter 7, then read down that column. The values are ceilings, not targets: within them, the lowest lighting class that meets the assessed need governs (Section 5.3.3). Where binding law applicable to the place sets a value, or requires a minimum for traffic safety, that law prevails over this table. The notes below the table qualify individual rows and are part of the requirement; the basis block records where each value comes from. The values are not intended for sports installations, which are outside the scope of these Guidelines.

The deep night. Rows that give two values give the level permitted before the deep night and the level permitted during it. The deep night is the protected core of the night: it begins at the middle of the night, the midpoint between sunset and dawn, may be moved by no more than one hour, and lasts at least three hours (Section 5.4). Where a binding national rule sets fixed clock hours instead, those hours apply.

Which zone? The Mediterranean lighting zones (Chapter 7, Table 1)

Zone	Character	Typical Mediterranean settings	Lighting principle
MZ0	Naturally dark	Sea-turtle nesting beaches; the most strictly protected categories of nature reserve; parks established for the protection of the night sky; shelters of light-sensitive species and the dark corridors between them; surroundings of professional observatories	No new lighting. Where orientation for pedestrians is indispensable, only the minimal lighting foreseen in Annex 2
MZ1	Dark landscape	Undeveloped stretches of the coast; rural hinterland with limited night-time activity; inter-settlement local roads, generally unlit; protected areas outside settlements	Lighting only exceptionally, at the lowest level, switched off when not needed
MZ2	Low ambient brightness	Villages and smaller settlements; residential edges of towns; settlements within nature parks	Restrained lighting where a need is demonstrated; darkness remains the norm between lit places
MZ3	Medium ambient brightness	Towns; tourism settlements in season; main streets; public roads for motor vehicles as transport infrastructure	Standard public lighting within the limits of Annex 2, reduced in the deep night
MZ4	High ambient brightness	Town and city centres and ports with genuinely high night-time activity	The fullest lighting these Guidelines foresee, still bounded by Annex 2 and reduced in the deep night

An MZ0 area is always surrounded by MZ1 (buffer rule). The assignment of an area to a zone follows the criteria of Chapter 7 of the Guidelines.

Table 5 – Limit values by Mediterranean zone

Two values = before / during the deep night. Notes 1–6 below are part of the requirement.

Parameter	MZ0	MZ1	MZ2	MZ3	MZ4
Upward light of the luminaire (ULOR; FHS in the Spanish framework) (note 1)	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
Maximum colour temperature (CCT) (note 2)	Amber, ≤ 2200 K, no emission below 440 nm	≤ 2200 K	≤ 2700 K	≤ 3000 K	≤ 3000 K
Blue content (G index or equivalent), where luminaire data allow (note 3)	G ≥ 2	G ≥ 2	G ≥ 1.5	G ≥ 1.5	G ≥ 1.5
Roads with motor traffic: maximum average horizontal illuminance, before / during the deep night (lx)	No new road lighting foreseen (note 6)	12 / 3	20 / 5	30 / 8	30 / 8
Pedestrian and cycle paths: maximum average horizontal illuminance, before / during the deep night (lx)	1 / 0	8 / 2	10 / 3	15 / 4	15 / 4
Water surfaces: maximum average horizontal illuminance from road and public lighting, before / during the deep night (lx) (note 4)	0 / 0	3 / 1	6 / 2	8 / 3	10 / 4
Illuminance at the windows of neighbouring buildings, including premises used for rest or recovery (before / during the deep night, lx)	0.5 / 0 lx	1 / 0 lx	2 / 0.5 lx	3 / 1 lx	8 / 2 lx
Luminance of facades and monuments (average over the lit surface, cd/m²) (note 5)	Not permitted	Not permitted, except as note 5 provides	≤ 5	≤ 10	≤ 25
Advertising and signage (luminance; regime)	Not permitted	Not permitted	Externally lit from above ≤ 10 cd/m², internally lit ≤ 5 cd/m²; no large displays; reduced or off in deep night	≤ 20 cd/m²; large displays only here and in MZ4; reduced or off in deep night; panels over 20 m² switched off	≤ 20 cd/m²; reduced or off in deep night; panels over 20 m² switched off
Total installed luminous flux of an installation per lit surface	No new lighting foreseen	< 25 lm/m²	< 35 lm/m²	< 35 lm/m²	< 35 lm/m²

Notes

Note 1. The luminaire value is met only if the mounting matches it: a fully shielded luminaire tilted upward emits light above the horizontal whatever its type-test rating, so luminaires shall be installed horizontally, without tilt, and the upward emission of the installation as built shall likewise be zero. Exceptions apply only as binding law provides, for example: decorative and landscape lighting confined to the outline of the lit object (Croatia); street lighting in cultural-monument areas, luminaires forming part of a monument, sports-field lighting within settlement areas and construction-site lighting during works, each under the conditions of the decree (Slovenia); road-installation tolerances by zone (ULORinst, Croatia).

Note 2. Overlay, regardless of zone: within protected areas ≤ 2200 K with G ≥ 2 (Croatian model, which ties this value to the protected area, not to a zone).

Note 3. Where the G index cannot be calculated from the luminaire data, the colour-temperature condition alone applies (Croatian fallback). The Spanish framework restricts the spectrum in its darkest zone by a different route (sodium lamps or filtering below 440 nm).

Note 4. Water surfaces: measured 5 m from the edge of the useful light of the installation; the direct lighting of water surfaces remains prohibited (Section 5.3.4).

Note 5. Facades and monuments. The value is the average luminance over the whole lit surface.

Decorative lighting (facades and monuments, and also statues, walls, fountains and similar) is not permitted in the two darkest zones; in MZ1 it is admissible only exceptionally, on the conditions set by the competent authority, and switched off in the deep night.

The light is confined within the outline of the lit object. Two limits control the small amount that may still escape, and they work on different quantities rather than competing. First, how much may miss the object: where the shape of the structure makes full confinement impossible, up to 10 % of the flux may pass the object (in the partner frameworks this applies to specific forms such as towers, spires and lattice structures, and, for cultural monuments that cannot be lit with luminaires emitting no light above the horizontal, with the outer edge of the lit surface at least 1 m below the eaves or the top of the structure). Second, how the light is aimed: lighting should be directed from above downwards, and where that is impossible the line of maximum intensity should stay no more than 30 degrees above the horizontal; in every case the intensity projected outside the lit surface shall stay within 50 cd/klm.

A facade is lit only within a settlement served by public lighting and close to an already lit public surface. A wall carrying the windows of protected premises used for rest or recovery in dwellings is not lit at all. In the deep night the lighting is reduced by at least half or switched off.

Achieved luminance is verified by measurement at a minimum of ten points evenly distributed over the whole lit surface, taken from no more than 50 m, or from behind the luminaires where feasible, with the meter no more than 2 m above the ground.

Note 6. MZ0 roads. The value is the position of these Guidelines, not a national limit; the Croatian framework caps a road in its darkest zone at 1 lx before the deep night and 0 lx during it, and leaves the decision whether to light roads outside built-up areas to the municipal lighting plan. Pedestrian orientation is provided for in the row for pedestrian and cycle paths and, in parks established for the protection of the night sky, at up to 1 lx. Where an existing installation cannot yet be removed, 1 / 0 lx applies until it is.

Basis of the values (informative)

The direction of the values, warmer light, less blue content, lower levels and deeper-night reductions, follows the evidence reviewed in Chapter 3; the thresholds themselves are taken from European legislation in force, which is where numeric limits exist. Where more than one framework sets a value for the same parameter, this annex adopts the stricter of them. Two rows depart from that: the facade and monument row, for the reason given below, and the rows for which only one framework sets a value at all, which are marked as such.

Upward light: the Croatian Act (2019) and the Slovenian decree (2007), both 0 % for the luminaire. For the installation as built the national frameworks are less strict, allowing 1 to 3 % (Croatia) and 1 to 25 % as FHSinst (Spain); the requirement of note 1 is nevertheless already applied at municipal level, since the Gudar-Javalambre by-laws require FHSinst of 0 % with flat glass and no tilt (D.3.1.2). The choice not to graduate this parameter by zone follows the reasoning recorded in the European procurement work, where stakeholders repeatedly stated that zoning is of limited use for upward light because light emitted near the horizontal can travel and scatter over a hundred kilometres, and where 0.0 % is described as readily achievable with correctly installed LED luminaires, verifiable in situ and beneficial for the maintenance factor because it prevents the deposition of dirt (Donatello et al. 2019).

Colour temperature: 3000 K = the Croatian and French general ceilings; 2200 K = the Croatian protected-area value; 2700 K = the French park-settlement value and the Teruel by-laws, interpolated by these Guidelines; the MZ0 package = the Croatian provision permitting colour-mixing systems up to 2200 K for landscape lighting, and the Spanish rule for zone E1, which requires the filtering of radiation below 440 nm where sodium lamps cannot be used (ITC-EA-03, section 1.2).

Blue content: the Croatian G index thresholds, which the European Green Public Procurement criteria use in the same way, requiring at least 1.5 generally and at least 2.0 in parks, gardens, ecologically sensitive areas and the surroundings of optical astronomical observatories (European Commission 2018).

Road and pedestrian-path maxima: the Croatian zone tables (values before and during the deep night; the roadside-paths category is applied here to pedestrian and cycle surfaces generally); the orientation-lighting value for night-sky protection parks follows the Croatian rules for that park category, which permit only pedestrian orientation lighting there, at up to 1 lx, without the obligation to meet other photometric parameters and with flux above the horizontal prohibited. The MZ0 entry for roads is explained in note 6.

Windows: the Croatian implementing regulation limits the vertical illuminance at the openings, doors and windows, of neighbouring buildings generally, and this annex follows that wider scope; the Slovenian decree limits it only at the windows of protected premises, that is, premises in residential buildings and in buildings used for childcare, education, health, hotel accommodation or similar activities that are intended mainly for rest or recovery. The Croatian graduated set is the strictest of the three; the Slovenian decree graduates the same quantity by environmental area and time of night, the Spanish by zone, both reaching 25 lx at the top of their scales.

Facades and monuments: this row takes its values from the Spanish framework (RD 1890/2008), which is the most complete of the three, since it sets an average luminance by zone, a maximum luminance and rules for aiming the projector. The values used here are the Spanish

zone values for average luminance, 5, 10 and 25 cd/m², applied in MZ2, MZ3 and MZ4. A graduated set is used rather than one value for all zones because the light a facade needs varies with the reflectance of its material, so a single figure is either too tight for dark stone or too loose for light stone. The Spanish framework recognises this in its own design tables, which set higher reference levels for dark materials than for light ones, although those tables are minimum design levels and not the source of the ceilings used here. Decorative lighting is not permitted in MZ0 and MZ1, following the Croatian prohibition in the two darkest zones, so these values apply only where such lighting is admissible at all. The Slovenian rule (1 cd/m², without zones), the Italian rule in Lazio (2 cd/m² for the facades of heritage buildings of regular shape and for any facade of irregular shape, whether heritage or not, and 1 cd/m² for all other buildings, with lighting from below upwards prohibited on the latter) and the Croatian rule (5, 10, 20) remain stricter in their own territories and prevail there under the subordination clause. The Lazio regulation also expresses the confinement rule of note 5 through the shape of the building itself, allowing 5 % of the flux emitted by the luminaires to reach the upper hemisphere without being intercepted by the lit structure on a heritage facade of regular shape, and 10 % on any facade of irregular shape.

Advertising: the Croatian zone tables, which set separate values for signs lit by external luminaires mounted on the top edge and directed downwards, for internally lit static signs, and for large displays, the last admitted only where the luminaire emits no light above the horizontal. The switch-off rules combine the Croatian and Slovenian provisions.

Water surfaces: the Croatian zone table for water surfaces along roads.

Installed flux per lit surface: the French decree, which requires strictly less than 35 lm/m² inside a settlement and strictly less than 25 lm/m² outside one for lighting that serves the safety of movement. That decree differentiates further by type of space, requiring lower values for parks and gardens (25 and 10 lm/m²) and for non-residential buildings and car parks (25 and 20 lm/m²); this annex applies a single value per zone to all installations.

Deep night: the Croatian definition of the curfew, that is, a start at the middle of the night with a deviation of at most one hour and a minimum duration of three hours; fixed-hour regimes apply where the applicable framework uses them.

Annex 1 compares how each framework regulates these parameters. The legislation itself is listed below and in the List of sources.

Table 6 – Indicative correspondence of the Mediterranean zones to the existing zone ladders

France, Italy and Slovenia regulate by situation rather than by a zone ladder; their binding rules are compared in Annex 1, and their areas are assigned to the Mediterranean zones directly by the criteria of Chapter 7. In every framework, the assignment of a specific area to a zone follows the criteria of Chapter 7.

Zone	CIE 150	Croatia	Spain
MZ0	E0	E0 (within an E1 surround)	E1
MZ1	E1	E1	E1
MZ2	E2	E2	E2
MZ3	E3	E3	E3
MZ4	E4	E4	E4

Sources: Croatia: Zakon o zaštiti od svjetlosnog onečišćenja, Narodne novine 14/2019; Pravilnik o zonama rasvjetljenosti, dopuštenim vrijednostima rasvjetljavanja i načinima upravljanja rasvjetnim sustavima, Narodne novine 128/2020. France: Arrêté du 27 décembre 2018 relatif à la prévention, à la réduction et à la limitation des nuisances lumineuses (as amended). Italy (Lazio): legge regionale 13 aprile 2000, n. 23; regolamento regionale 18 aprile 2005, n. 8. Slovenia: Uredba o mejnih vrednostih svetlobnega onesnaževanja okolja, Uradni list RS 81/2007 (as amended). Spain: Real Decreto 1890/2008 and its complementary technical instructions, i in particular ITC-EA-02, ITC-EA-03 and ITC-EA-04; municipal lighting by-laws of the Gúdar-Javalambre region, Province of Teruel. International: CIE 150:2017. Full references are given in the List of sources.