English Version

Lighting of work places - Part 2: Outdoor work places

This European Standard was approved by CEN on 16 January 2006.

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Foreword

This document (EN 12464-2:2007) has been prepared by Technical Committee CEN/TC 169 “Light and lighting”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2008, and conflicting national standards shall be withdrawn at the latest by January 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

EN 12464 Light and lighting - Lighting of work places is published in 2 parts:

— Part 1: Indoor work places;
— Part 2: Outdoor work places

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.
Introduction

To enable people to perform outdoor visual tasks efficiently and accurately, especially during the night, adequate and appropriate lighting has to be provided.

The degree of visibility and comfort required in a wide range of outdoor work places is governed by the type and duration of activity.

This standard specifies requirements for lighting of tasks in most outdoor work places and their associated areas in terms of quantity and quality of illumination. In addition recommendations are given for good lighting practice.

It is important that all clauses of the standard are followed although the specific requirements are tabulated in the schedule of lighting requirements (see clause 5).

1 Scope

This European standard specifies lighting requirements for outdoor work places, which meet the needs for visual comfort and performance. All usual visual tasks are considered.

This European standard does not specify lighting requirements with respect to the safety and health of workers at work and has not been prepared in the field of application of Article 137 of the EC treaty, although the lighting requirements, as specified in this standard, usually fulfil safety needs. Lighting requirements with respect to the safety and health of workers at work may be contained in Directives based on Article 137 of the EC treaty, in national legislation of member states implementing these directives or in other national legislation of member states.

This standard neither provides specific solutions, nor restricts the designer’s freedom from exploring new techniques nor restricts the use of innovative equipment.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1838, Lighting applications — Emergency lighting.

EN 12193, Light and lighting — Sports lighting.

EN 12665, Light and lighting — Basic terms and criteria for specifying lighting requirements.

EN 13032-2, Light and lighting — Measurement and presentation of photometric data of lamps and luminaires - Part 2: Presentation of data for indoor and outdoor work places.

EN 13201 (all parts), Road lighting.

ISO 3864-1, Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in work places and public areas.


3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 12665 and the following apply.

NOTE This clause defines terms and quantities that are in use and important to this standard, and which may not be given in IEC 60050-845/ CIE 17.4 [3].

3.1 curfew
time during which stricter requirements (for the control of obtrusive light) will apply; often a condition of use of lighting applied by a government controlling authority, usually the local government

3.2 diversity
\( U_d \)
ratio of minimum illuminance (luminance) to maximum illuminance (luminance) on (of) a surface

3.3 glare rating limit
\( GRL \)
upper limit of glare by the CIE Glare Rating system

3.4 maintained illuminance
\( E_m \)
value below which the average illuminance on the specified surface is not allowed to fall

NOTE It is the average illuminance at the time maintenance should be carried out.

3.5 obtrusive light
spill light, which because of quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction or a reduction in the ability to see essential information

3.6 spill light (stray light)
light emitted by a lighting installation which falls outside the boundaries of the property for which the lighting installation is designed

3.7 surrounding area
band surrounding the task area within the field of vision

NOTE This band should have a width of at least 2 m.

3.8 task area
partial area in the work place in which the visual task is carried out. For places where the size and/or location of the task area are unknown, the area where the task may occur is the task area

3.9 illuminance uniformity
\( U_o \)
ratio of minimum illuminance (luminance) to average illuminance (luminance) on (of) a surface

NOTE See also IEC 60050-845/ CIE 17.4 [3]; 845-09-58 uniformity ratio of illuminance.

3.10 upward light ratio
\( ULR \)
proportion of the flux of the luminaire(s) that is emitted above the horizontal, when the luminaire(s) is (are) mounted in its (their) installed position and attitude
3.11 visual task
visual elements of the work being done

NOTE The main visual elements are the size of the structure, its luminance, its contrast against the background and its duration.

3.12 work place
place intended to house work stations on the premises of the undertaking and/or establishment and any other place within the area of undertaking and/or establishment to which the worker has access in the course of his employment

3.13 work station
combination and spatial arrangement of work equipment, surrounded by the work environment under the conditions imposed by the work tasks

4 Lighting design criteria

4.1 Luminous environment

For good lighting practice it is essential that, in addition to the required illuminance, other qualitative and quantitative needs are satisfied.

Lighting requirements are determined by the satisfaction of three basic human needs:

— visual comfort, where the workers have a feeling of well-being; in an indirect way also contributing to a high productivity level,

— visual performance, where the workers are able to perform their visual tasks, even under difficult circumstances and during longer periods,

— safety.

Main parameters determining the luminous environment are:

— luminance distribution,

— illuminance,

— glare,

— directionality of light,

— colour rendering and colour appearance of the light,

— flicker.

Values for illuminance, glare rating and colour rendering are given in clause 5.

4.2 Luminance distribution

The luminance distribution in the field of view controls the adaptation level of the eyes, which affects task visibility.

A well balanced luminance distribution is needed to increase:

— visual acuity (sharpness of vision),
contrast sensitivity (discrimination of small relative luminance differences),

— efficiency of the ocular functions (such as accommodation, convergence, pupillary contraction, eye movements.).

The luminance distribution in the field of view also affects visual comfort. Sudden changes in luminance should be avoided.

4.3 Illuminance

The illuminance and its distribution on the task area and the surrounding area have a great impact on how quickly, safely and comfortably a person perceives and carries out the visual task.

All values of illuminances specified in this standard are maintained illuminances and will provide for visual comfort, visual performance and safety needs.

4.3.1 Illuminance on the task area

The values given in clause 5 are maintained illuminances over the task area on the reference surface, which may be horizontal, vertical or inclined. The average illuminance for each task shall not fall below the value given in clause 5, regardless of the age and condition of the installation.

NOTE The values are valid for normal visual conditions and take into account the following factors:

— psycho-physiological aspects such as visual comfort and well-being,
— requirements for visual tasks,
— visual ergonomics,
— practical experience,
— safety,
— economy.

The value of illuminance may be adjusted by at least one step in the scale of illuminances (see below), if the visual conditions differ from the normal assumptions.

A factor of approximately 1.5 represents the smallest significant difference in subjective effect of illuminance. The recommended scale of illuminance (in lx) is:


The required maintained illuminance should be increased, when:

— visual work is critical,
— visual task or worker is moving,
— errors are costly to rectify,
— accuracy or higher productivity is of great importance,
— the visual capacity of the worker is below normal,
— task details are of unusually small size or low contrast,
— the task is undertaken for an unusually long time.

The required maintained illuminance may be decreased when:
— task details are of an unusually large size or high contrast,
— the task is undertaken for an unusually short time or on only rare occasions.

4.3.2 Illuminance of surroundings

The illuminance of surrounding areas shall be related to the illuminance of the task area and should provide a well-balanced luminance distribution in the field of view.

Large spatial variations in illuminances around the task area may lead to visual stress and discomfort.

The illuminance of the surrounding areas may be lower than the task illuminance but shall be not less than the values given in Table 1.

<table>
<thead>
<tr>
<th>Task illuminance</th>
<th>Illuminance of surrounding areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥500</td>
<td>100</td>
</tr>
<tr>
<td>300</td>
<td>75</td>
</tr>
<tr>
<td>200</td>
<td>50</td>
</tr>
<tr>
<td>150</td>
<td>30</td>
</tr>
<tr>
<td>50 ≤ $E_m$ ≤ 100</td>
<td>20</td>
</tr>
<tr>
<td>&lt; 50</td>
<td>no specification</td>
</tr>
</tbody>
</table>

In addition to the task illuminance the lighting shall provide adequate adaptation luminance in accordance with clause 4.2.

4.3.3 Illuminance grid

A grid system shall be created for the task and surrounding areas to indicate the points at which the illuminance values are calculated and verified.

Grids approximating a square are preferred, the ratio of length to width of a grid cell shall be kept between 0,5 and 2 (see also EN 12193). The maximum grid size shall be:

$$ p = 0,2 \times 5^{\log d} \tag{1} $$

where:

- $d$ is the longer dimension of the area, in m, if the ratio of the longer to the shorter side is less than 2, otherwise $d$ is the shorter dimension of the area, and
- $p$ is the maximum grid cell size in m.

The value of $p$ should be that $p \leq 10$ m.

4.3.4 Uniformity and diversity

The task area shall be illuminated as uniformly as possible. The illuminance uniformity of the task area shall be not less than the values given in clause 5. The uniformity of the surroundings shall not be less than 0,10.

In some cases e.g. railways, illuminance diversity is also an important quality criterion.
4.4 Glare

Glare is the sensation produced by bright areas within the field of view and may be experienced either as discomfort glare or disability glare. Glare caused by reflections in specular surfaces is usually known as veiling reflections or reflected glare.

It is important to limit the glare to the users to avoid errors, fatigue and accidents.

NOTE Special care is needed to avoid glare when the direction of view is above horizontal.

4.4.1 Glare rating

The glare directly from the luminaires of an outdoor lighting installation shall be determined using the CIE Glare Rating (GR) method, based on the formula:

\[
GR = 27 + 24 \log_{10} \left( \frac{L_{vl}}{L_{ve}} \right)
\]

where:

- \(L_{vl}\) is the total veiling luminance in \(\text{cd} \cdot \text{m}^{-2}\) caused by the lighting installation and is the sum of the veiling luminances produced by each individual luminaire (\(L_{vl} = L_{v1} + L_{v2} + \ldots + L_{vn}\)). The veiling luminance of the individual luminaires is calculated as \(L_v = 10 \cdot (E_{eye} \cdot \Theta)^2\), in which \(E_{eye}\) is the illuminance at the observer's eye in a plane perpendicular to the line of sight (2° below horizontal, see Fig. 1) and \(\Theta\) is the angle between the observer's line of sight and the direction of the light incident from the individual luminaire.

- \(L_{ve}\) is the equivalent veiling luminance of the environment in \(\text{cd} \cdot \text{m}^{-2}\). From the assumption that the reflection of the environment is totally diffuse, the equivalent veiling reflection from the environment may be calculated as \(L_{ve} = 0.035 \cdot \rho \cdot E_{hav} \cdot \pi^{-1}\), in which \(\rho\) represents the average reflectance and \(E_{hav}\) the average horizontal illuminance of the area.

![Diagram](image)

**Key:**
1. line of sight
2. plane of \(E_{eye}\)

**Figure 1 — The angle between the observer's line of sight and the direction of the light incident from the individual luminaire**

NOTE GR should be computed at grid positions as defined in 4.3.3, at 45° intervals radially about the grid points with 0° direction parallel to the long side of the task area.

All assumptions made in the determination of GR shall be stated in the scheme documentation. The GR value of the lighting installation shall not exceed the \(GR_L\)-value given in clause 5.
4.4.2 Veiling reflections and reflected glare

High brightness reflections in the visual task may alter task visibility, usually detrimentally. Veiling reflections and reflected glare may be prevented or reduced by the following measures:

— appropriate arrangement of luminaires and work places,
— surface finish (e. g. matt surfaces),
— luminance restriction of luminaires,
— increased luminous area of the luminaire.

4.5 Obtrusive light

To safeguard and enhance the night time environment it is necessary to control obtrusive light (also known as light pollution), which can present physiological and ecological problems to surroundings and people.

The limits of obtrusive light for exterior lighting installations, to minimise problems for people, flora and fauna, are given in Table 2 and for road users in Table 3.

<table>
<thead>
<tr>
<th>Environmental zone</th>
<th>Light on properties</th>
<th>Luminaire intensity</th>
<th>Upward light</th>
<th>Luminance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$E_v$ [lx]</td>
<td>$I$ [cd]</td>
<td>$ULR$ [%]</td>
<td>$L_b$ [cd.m$^{-2}$]</td>
</tr>
<tr>
<td>Pre-curfew</td>
<td>Post-curfew</td>
<td>Pre-curfew</td>
<td>Post-curfew</td>
<td>Building facade</td>
</tr>
<tr>
<td>E1</td>
<td>2</td>
<td>0</td>
<td>2500</td>
<td>0</td>
</tr>
<tr>
<td>E2</td>
<td>5</td>
<td>1</td>
<td>7500</td>
<td>5</td>
</tr>
<tr>
<td>E3</td>
<td>10</td>
<td>2</td>
<td>10000</td>
<td>15</td>
</tr>
<tr>
<td>E4</td>
<td>25</td>
<td>5</td>
<td>25000</td>
<td>25</td>
</tr>
</tbody>
</table>

*In case no curfew regulations are available, the higher values shall not be exceeded and the lower values should be taken as preferable limits.*

Where:

E1 represents intrinsically dark areas, such as national parks or protected sites;

E2 represents low district brightness areas, such as industrial or residential rural areas;

E3 represents medium district brightness areas, such as industrial or residential suburbs;

E4 represents high district brightness areas, such as town centres and commercial areas.

and

$E_v$ is the maximum value of vertical illuminance on properties in lx;

$I$ is the light intensity of each source in the potentially obtrusive direction in cd;

$ULR$ is the proportion of the flux of the luminaire(s) that is emitted above the horizontal, when the luminaire(s) is (are) mounted in its (their) installed position and attitude, and given in %;
\( L_b \) is the maximum average luminance of the facade of a building in \( \text{cd} \cdot \text{m}^{-2} \);

\( L_s \) is the maximum average luminance of signs in \( \text{cd} \cdot \text{m}^{-2} \).

**Table 3 — Maximum values of threshold increment from non-road lighting installations**

<table>
<thead>
<tr>
<th>Light technical parameter</th>
<th>Road lighting classes (^{a)})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No road lighting</td>
</tr>
<tr>
<td>Threshold increment ((T_I)) (^{b)} c) d))</td>
<td>15 % based on adaptation luminance of 0.1 ( \text{cd} \cdot \text{m}^{-2} )</td>
</tr>
</tbody>
</table>

\(^{a)}\) Road lighting classes as given in EN 13201-2.

\(^{b)}\) \(T_I\) calculation as given in EN 13201-3.

\(^{c)}\) Limits apply where users of transport systems are subject to a reduction in the ability to see essential information. Values given are for relevant positions and for viewing directions in the path of travel.

\(^{d)}\) Table 5.2 in CIE 150:2003 gives corresponding values for the veiling luminance \( L_v \).

### 4.6 Directional lighting

Directional lighting may be used to highlight objects, reveal texture and improve the appearance of people. This is described by the term "modelling". Directional lighting of a visual task may also affect its visibility.

#### 4.6.1 Modelling

Modelling is the balance between diffuse and directional light. It is a valid criterion of lighting quality in virtually all applications. The people and objects should be lit so that form and texture are revealed clearly and pleasingly. This occurs when the light comes predominantly from one direction; the shadows so essential to good modelling are then formed without confusion.

The lighting should not be too directional or it will produce harsh shadows.

#### 4.6.2 Directional lighting of visual tasks

Lighting from a specific direction may reveal details within a visual task, increasing their visibility and making the task easier to perform. Veiling reflections and reflected glare should be avoided, see 4.4.2.

### 4.7 Colour aspects

The colour qualities of a near-white lamp are characterised by two attributes:

— the colour appearance of the lamp itself;

— its colour rendering capabilities, which affect the colour appearance of objects and persons illuminated by the lamp.

These two attributes shall be considered separately.

#### 4.7.1 Colour appearance

The "colour appearance" of a lamp refers to the apparent colour (chromaticity) of the light emitted. It is quantified by its correlated colour temperature \((T_{\text{CP}})\).

Colour appearance may also be described as in Table 4.
Table 4 — Lamp colour appearance groups

<table>
<thead>
<tr>
<th>Colour appearance</th>
<th>Correlated colour temperature $T_{CP}$ K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm</td>
<td>below 3 300</td>
</tr>
<tr>
<td>Intermediate</td>
<td>3 300 to 5 300</td>
</tr>
<tr>
<td>Cool</td>
<td>above 5 300</td>
</tr>
</tbody>
</table>

The choice of colour appearance is a matter of psychology, aesthetics and of what is considered to be natural.

4.7.2 Colour rendering

It is important for visual performance and the feeling of comfort and well being that colours in the environment, of objects and of human skin are rendered naturally, correctly and in a way that makes people look attractive and healthy.

To provide an objective indication of the colour rendering properties of a light source, the general colour rendering index $R_a$ has been introduced. The maximum value of $R_a$ is 100. This figure decreases with decreasing colour rendering quality.

Safety colours shall always be recognisable as such and therefore light sources shall have colour rendering indices $\geq 20$ (see also ISO 3864-1).

The minimum values of colour rendering index for distinct areas, tasks or activities are given in clause 5.

4.8 Flicker and stroboscopic effects

Flicker causes distraction and may give rise to physiological effects such as headaches.

Stroboscopic effects can lead to dangerous situations by changing the perceived motion of rotating or reciprocating machinery.

Lighting systems should be designed to avoid flicker and stroboscopic effects.

NOTE This can usually be achieved by technical measures adjusted to the chosen lamp type (i.e. operating discharge lamps at high frequencies).

4.9 Maintenance factor (MF)

The lighting scheme should be designed with a maintenance factor calculated for the selected lighting equipment, space environment and specified maintenance schedule, as defined in CIE 154:2003.

The recommended illuminance for each task is given as maintained illuminance. The maintenance factor depends on the maintenance characteristics of the lamp and control gear, the luminaire, the environment and the maintenance programme.

The designer shall:

— state the maintenance factor and list all assumptions made in the derivation of the value;
— specify lighting equipment suitable for the application environment;
— prepare a comprehensive maintenance schedule to include frequency of lamp replacement, luminaire cleaning intervals and cleaning method.
4.10 Energy considerations

A lighting installation should meet the lighting requirements of a particular area without waste of energy. However, it is important not to compromise the visual aspects of a lighting installation simply to reduce energy consumption. This requires the consideration of appropriate lighting systems, equipment and controls.

4.11 Sustainability

Considerations should be given to the sustainability of the lighting installation. The selected lighting equipment shall be fit for the purpose.

4.12 Emergency lighting

Emergency lighting should be provided to operate in the event of failure of the supply to the normal lighting system (see EN 1838).

5 Schedule of lighting requirements

The lighting requirements for various areas, tasks and activities are given in the tables of 5.3 (see also EN 12193). Lighting recommendations with respect to safety and health of workers at work are given in Annex A.

5.1 Composition of the tables 5.1 to 5.15 below

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>lists the reference number for each area, task or activity.</td>
<td>lists those areas, tasks or activities for which specific requirements are given. If the particular area, task or activity is not listed, the values given for a similar, comparable situation should be adopted.</td>
<td>gives the maintained illuminance $E_m$ on the reference surface (see 4.3) for the area, task or activity given in column 2.</td>
<td>gives the minimum illuminance uniformity $U_o$ on the reference surface (see 4.3) for the area, task or activity given in column 2.</td>
<td>gives the Glare Rating limits ($GR_L$) where these are applicable to the situations listed in column 2 (see 4.4)</td>
<td>gives the minimum colour rendering indices ($R_a$) (see 4.6.2) for the situation listed in column 2.</td>
<td>contains advice and footnotes for exceptions and special applications for the situations listed in column 2.</td>
</tr>
</tbody>
</table>

NOTE Lighting control may be required to achieve adequate flexibility for the variety of tasks performed.

5.2 The schedule of areas, tasks and activities

| Table 5.1 General circulation areas at outdoor work places |
| Table 5.2 Airports |
| Table 5.3 Building sites |
| Table 5.4 Canals, locks and harbours |
| Table 5.5 Farms |
| Table 5.6 Fuel filling stations |
Table 5.7 Industrial sites and storage areas
Table 5.8 Off shore gas and oil structures
Table 5.9 Parking areas
Table 5.10 Petrochemical and other hazardous Industries
Table 5.11 Power, electricity, gas and heat plants
Table 5.12 Railways and tramways
Table 5.13 Saw mills
Table 5.14 Shipyards and docks
Table 5.15 Water and sewage plants

5.3 Lighting requirements for areas, tasks and activities

Table 5.1 — General circulation areas at outdoor work places

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$\mathcal{E}_m$</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_\alpha$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1</td>
<td>Walkways exclusively for pedestrians</td>
<td>5</td>
<td>0,25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.1.2</td>
<td>Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators</td>
<td>10</td>
<td>0,40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.1.3</td>
<td>Regular vehicle traffic (max. 40 km/h)</td>
<td>20</td>
<td>0,40</td>
<td>45</td>
<td>20</td>
<td>At shipyards and in docks, $GR_L$ may be 50</td>
</tr>
<tr>
<td>5.1.4</td>
<td>Pedestrian passages, vehicle turning, loading and unloading points</td>
<td>50</td>
<td>0,40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

NOTE For routes, as there are no international standards, consult the appropriate road lighting recommendations.

Table 5.2 — Airports

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$\mathcal{E}_m$</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_\alpha$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2.1</td>
<td>Hangar apron</td>
<td>20</td>
<td>0,10</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.2.2</td>
<td>Terminal apron</td>
<td>30</td>
<td>0,20</td>
<td>50</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.2.3</td>
<td>Loading areas</td>
<td>50</td>
<td>0,20</td>
<td>50</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.2.4</td>
<td>Fuel depot</td>
<td>50</td>
<td>0,20</td>
<td>50</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.2.5</td>
<td>Aircraft maintenance stands</td>
<td>200</td>
<td>0,50</td>
<td>45</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

1. Direct light in the direction of the control tower and landing aircraft shall be avoided.
2. Direct light emitted above horizontal from floodlights should be restricted to the minimum.
Table 5.3 — Building sites

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ ($\text{lx}$)</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3.1</td>
<td>Clearance, excavation and loading</td>
<td>20</td>
<td>0.25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.3.2</td>
<td>Construction areas, drain pipes mounting, transport, auxiliary and storage tasks</td>
<td>50</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.3.3</td>
<td>Framework element mounting, light reinforcement work, wooden mould and framework mounting, electric piping and cabling</td>
<td>100</td>
<td>0.40</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.3.4</td>
<td>Element jointing, demanding electrical, machine and pipe mountings</td>
<td>200</td>
<td>0.50</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.4 — Canals, locks and harbours

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ ($\text{lx}$)</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.4.1</td>
<td>Waiting quays at canals and locks</td>
<td>10</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.4.2</td>
<td>Gangways and passages exclusively for pedestrians</td>
<td>10</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.4.3</td>
<td>Lock control and ballasting areas</td>
<td>20</td>
<td>0.25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.4.4</td>
<td>Cargo handling, loading and unloading</td>
<td>30</td>
<td>0.25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.4.5</td>
<td>Passenger areas in passenger harbours</td>
<td>50</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.4.6</td>
<td>Coupling of hoses, pipes and ropes</td>
<td>50</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.4.7</td>
<td>Dangerous part of walkways and driveways</td>
<td>50</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

For reading labels: $E_m = 50 \text{ lx}$

Table 5.5 — Farms

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ ($\text{lx}$)</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5.1</td>
<td>Farm yard</td>
<td>20</td>
<td>0.10</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.5.2</td>
<td>Equipment shed (open)</td>
<td>50</td>
<td>0.20</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.5.3</td>
<td>Animals sorting pen</td>
<td>50</td>
<td>0.20</td>
<td>50</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.6 — Fuel filling stations

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ ($\text{lx}$)</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6.1</td>
<td>Vehicle parking and storage areas</td>
<td>5</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.6.2</td>
<td>Entry and exit driveways: dark environment (i.e. rural areas and suburbs)</td>
<td>20</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.6.3</td>
<td>Entry and exit driveways: light environment (i.e. cities)</td>
<td>50</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.6.4</td>
<td>Air pressure and water checking points and other service areas</td>
<td>150</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.6.5</td>
<td>Meter reading area</td>
<td>150</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
### Table 5.7 — Industrial sites and storage areas

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$\bar{E}_m$ (lx)</th>
<th>$\bar{U}_o$</th>
<th>$\bar{GR}_L$</th>
<th>$\bar{R}_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.7.1</td>
<td>Short term handling of large units and raw materials, loading and unloading of solid bulk goods</td>
<td>20</td>
<td>0.25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.7.2</td>
<td>Continuous handling of large units and raw materials, loading and unloading of freight, lifting and descending location for cranes, open loading platforms</td>
<td>50</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.7.3</td>
<td>Reading of addresses, covered loading platforms, use of tools, ordinary reinforcement and casting tasks in concrete plants</td>
<td>100</td>
<td>0.50</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.7.4</td>
<td>Demanding electrical, machine and piping installations, inspection</td>
<td>200</td>
<td>0.50</td>
<td>45</td>
<td>60</td>
<td>Use local lighting</td>
</tr>
</tbody>
</table>

### Table 5.8 — Off-shore gas and oil structures

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$\bar{E}_m$ (lx)</th>
<th>$\bar{U}_o$</th>
<th>$\bar{GR}_L$</th>
<th>$\bar{R}_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.8.1</td>
<td>Sea surface below the rig</td>
<td>30</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.8.2</td>
<td>Ladders, stairs, walkways</td>
<td>100</td>
<td>0.25</td>
<td>45</td>
<td>20</td>
<td>On treads</td>
</tr>
<tr>
<td>5.8.3</td>
<td>Boat landing areas / transport areas</td>
<td>100</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
| 5.8.4    | Helideck                                               | 100              | 0.40        | 45           | 20          | 1. Direct light in the direction of the control tower and landing aircraft shall be avoided.  
2. Direct light emitted above horizontal from floodlights should be restricted to the minimum. |
| 5.8.5    | Derrick                                                | 100              | 0.50        | 45           | 40          |                                                                         |
| 5.8.6    | Treatment areas                                        | 100              | 0.50        | 45           | 40          |                                                                         |
| 5.8.7    | Pipe rack area / deck                                  | 150              | 0.50        | 45           | 40          |                                                                         |
| 5.8.8    | Test station, shale shaker, wellhead                   | 200              | 0.50        | 45           | 40          |                                                                         |
| 5.8.9    | Pumping areas                                          | 200              | 0.50        | 45           | 20          |                                                                         |
| 5.8.10   | Life boat areas                                        | 200              | 0.40        | 50           | 20          |                                                                         |
| 5.8.11   | Drill floor and monkey board                           | 300              | 0.50        | 40           | 40          | Special attention to string entry is needed                            |
| 5.8.12   | Mud room, sampling                                     | 300              | 0.50        | 40           | 40          |                                                                         |
| 5.8.13   | Crude oil pumps                                        | 300              | 0.50        | 45           | 40          |                                                                         |
| 5.8.14   | Plant areas                                            | 300              | 0.50        | 40           | 40          |                                                                         |
| 5.8.15   | Rotary table                                           | 500              | 0.50        | 40           | 40          |                                                                         |
### Table 5.9 — Parking areas

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ (lx)</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.9.1</td>
<td>Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks</td>
<td>5</td>
<td>0.25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.9.2</td>
<td>Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes</td>
<td>10</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.9.3</td>
<td>Heavy traffic, e.g. parking areas of schools, churches, major shopping centres, major sports and multipurpose building complexes</td>
<td>20</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5.10 — Petrochemical and other hazardous industries

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ (lx)</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.10.1</td>
<td>Handling of servicing tools, utilisation of manually regulated valves, starting and stopping motors, lighting of burners</td>
<td>20</td>
<td>0.25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.10.2</td>
<td>Filling and emptying of container trucks and wagons with risk free substances, inspection of leakage, piping and packing</td>
<td>50</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.10.3</td>
<td>Filling and emptying of container trucks and wagons with dangerous substances, replacements of pump packing, general service work, reading of instruments</td>
<td>100</td>
<td>0.40</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.10.4</td>
<td>Fuel loading and unloading sites</td>
<td>100</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.10.5</td>
<td>Repair of machines and electric devices</td>
<td>200</td>
<td>0.50</td>
<td>45</td>
<td>60</td>
<td>Use local lighting</td>
</tr>
</tbody>
</table>

### Table 5.11 — Power, electricity, gas and heat plants

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ (lx)</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.11.1</td>
<td>Pedestrian movements within electrically safe areas</td>
<td>5</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.11.2</td>
<td>Handling of servicing tools, coal</td>
<td>20</td>
<td>0.25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.11.3</td>
<td>Overall inspection</td>
<td>50</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.11.4</td>
<td>General servicing work and reading of instruments</td>
<td>100</td>
<td>0.40</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.11.5</td>
<td>Wind tunnels: servicing and maintenance</td>
<td>100</td>
<td>0.40</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.11.6</td>
<td>Repair of electric devices</td>
<td>200</td>
<td>0.50</td>
<td>45</td>
<td>60</td>
<td>Use local lighting</td>
</tr>
</tbody>
</table>
### Table 5.12 — Railways and tramways

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>(E_m)</th>
<th>(U_o)</th>
<th>(GR_L)</th>
<th>(R_o)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.12.1</td>
<td>Tracks in passenger station areas, including stabling</td>
<td>10</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td>(U_o \geq \frac{1}{8})</td>
</tr>
<tr>
<td>5.12.2</td>
<td>Railway yards: flat marshalling, retarder and classification yards</td>
<td>10</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.3</td>
<td>Hump areas</td>
<td>10</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.4</td>
<td>Freight track, short duration operations</td>
<td>10</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td>(U_o \geq \frac{1}{8})</td>
</tr>
<tr>
<td>5.12.5</td>
<td>Open platforms, rural and local trains, small number of passengers</td>
<td>15</td>
<td>0.25</td>
<td>50</td>
<td>20</td>
<td>1. Special attention to the edge of the platform 2. (U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.6</td>
<td>Walkways</td>
<td>20</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.12.7</td>
<td>Level crossings</td>
<td>20</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.12.8</td>
<td>Open platforms, suburban and regional trains with large number of passengers or inter-city services with small number of passengers</td>
<td>20</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td>1. Special attention to the edge of the platform 2. (U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.9</td>
<td>Freight track, continuous operation</td>
<td>20</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.10</td>
<td>Open platforms in freight areas</td>
<td>20</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.11</td>
<td>Servicing trains and locomotives</td>
<td>20</td>
<td>0.40</td>
<td>50</td>
<td>40</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.12</td>
<td>Railway yards handling areas</td>
<td>30</td>
<td>0.40</td>
<td>50</td>
<td>20</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.13</td>
<td>Coupling area</td>
<td>30</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.14</td>
<td>Stairs, small and medium-size stations</td>
<td>50</td>
<td>0.40</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.12.15</td>
<td>Open platforms, inter-city services</td>
<td>50</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td>1. Special attention to the edge of the platform 2. (U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.16</td>
<td>Covered platforms, suburban or regional trains or inter-city services with small number of passengers</td>
<td>50</td>
<td>0.40</td>
<td>45</td>
<td>40</td>
<td>1. Special attention to the edge of the platform 2. (U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.17</td>
<td>Covered platforms in freight areas, short duration operations</td>
<td>50</td>
<td>0.40</td>
<td>45</td>
<td>20</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.18</td>
<td>Covered platforms, inter-city services</td>
<td>100</td>
<td>0.50</td>
<td>45</td>
<td>40</td>
<td>1. Special attention to the edge of the platform 2. (U_o \geq \frac{1}{3})</td>
</tr>
<tr>
<td>5.12.19</td>
<td>Stairs, large stations</td>
<td>100</td>
<td>0.50</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.12.20</td>
<td>Covered platforms in freight areas, continuous operation</td>
<td>100</td>
<td>0.50</td>
<td>45</td>
<td>40</td>
<td>(U_o \geq \frac{1}{5})</td>
</tr>
<tr>
<td>5.12.21</td>
<td>Inspection pit</td>
<td>100</td>
<td>0.50</td>
<td>40</td>
<td>40</td>
<td>Use low-glare local lighting</td>
</tr>
</tbody>
</table>
### Table 5.13 — Saw mills

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ [lx]</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.13.1</td>
<td>Timber handling on land and in water, sawdust and chip conveyors</td>
<td>20</td>
<td>0,25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.13.2</td>
<td>Sorting of timber on land or in water, timber unloading points and sawn timber loading points, mechanical lifting to timber conveyor, stacking</td>
<td>50</td>
<td>0,40</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.13.3</td>
<td>Reading of addresses and markings of sawn timber</td>
<td>100</td>
<td>0,40</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.13.4</td>
<td>Grading and packaging</td>
<td>200</td>
<td>0,50</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.13.5</td>
<td>Feeding into stripping and chopping machines</td>
<td>300</td>
<td>0,50</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5.14 — Shipyards and docks

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ [lx]</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.14.1</td>
<td>General lighting of shipyard area, storage areas for prefabricated goods.</td>
<td>20</td>
<td>0,25</td>
<td>55</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.14.2</td>
<td>Short term handling of large units</td>
<td>20</td>
<td>0,25</td>
<td>55</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.14.3</td>
<td>Cleaning of ship hull</td>
<td>50</td>
<td>0,25</td>
<td>50</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.14.4</td>
<td>Painting and welding of ship hull</td>
<td>100</td>
<td>0,40</td>
<td>45</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>5.14.5</td>
<td>Mounting of electrical and mechanical components</td>
<td>200</td>
<td>0,50</td>
<td>45</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5.15 — Water and sewage plants

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>$E_m$ [lx]</th>
<th>$U_o$</th>
<th>$GR_L$</th>
<th>$R_a$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.15.1</td>
<td>Handling of service tools, utilisation of manually operated valves, starting and stopping of motors, piping packing and raking plants</td>
<td>50</td>
<td>0,40</td>
<td>45</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.15.2</td>
<td>Handling of chemicals, inspection of leakage, changing of pumps, general servicing work, reading of instruments</td>
<td>100</td>
<td>0,40</td>
<td>45</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5.15.3</td>
<td>Repair of motors and electric devices</td>
<td>200</td>
<td>0,50</td>
<td>45</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>
6 Verification procedures

Verification of the lighting installation shall be by measurement, calculation or inspection of data (see EN 13032-2).

6.1 Illuminance

Verification of illuminances and uniformities that relate to specific tasks shall be measured in the plane of the task and the measurement points chosen shall coincide with the design points or grid used.

NOTE When verifying illuminance, account should be taken of the calibration of the light meters used, the conformity of the lamps and luminaires to the published photometric data, and of the design assumptions made about surface reflectances, etc., compared with the real values.

The average illuminance and uniformity shall be not less than the values given in clause 5 and Table 1 respectively.

6.2 Glare Rating

Verification shall be by inspection of the design data and parameters provided for the scheme. All assumptions shall be declared.

6.3 Colour Rendering Index

Authenticated $R_a$ data shall be provided for the lamps in the scheme by the manufacturer of the lamps. The lamps shall conform to the requirements.

The lamps shall be as specified in the design.

6.4 Obtrusive light

Calculated values for $E_v$, $I$, $ULR$, $L_b$, $L_s$ and $TI$ shall be provided by the scheme designer.

Verification of $E_v$, $L_b$, and $L_s$ shall be made by measurement taking into account all design assumptions.
## Annex A
(informative)

### Lighting requirements for safety and security

<table>
<thead>
<tr>
<th>Risk level</th>
<th>( E_m ) ( \text{lx} )</th>
<th>( U_o )</th>
<th>( GR_L )</th>
<th>( R_a )</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low risks, i.e.</td>
<td>5</td>
<td>0,25</td>
<td>55</td>
<td>20</td>
<td>Storage areas with occasional traffic in industrial yards; Coal fields in power plants; Timber storage, sawdust and wood chip fields in saw mills; Occasionally used service passages and stairs, waste water cleaning and aeration tanks, filter and sludge digestion tanks in water and sewage plants.</td>
</tr>
<tr>
<td>Low risks, i.e.</td>
<td></td>
<td>0,40</td>
<td>50</td>
<td>20</td>
<td>General lighting in harbours; Areas of risk free process and occasionally used platforms and stairs in petrochemical and other hazardous industries; Sawn timber storage areas in saw mills. In harbours, ( U_o ) may be 0,25</td>
</tr>
<tr>
<td>Medium risks, i.e.</td>
<td>20</td>
<td>0,40</td>
<td>50</td>
<td>20</td>
<td>Vehicle storage areas and container terminals with frequent traffic in harbours, industrial yards and storage areas; Vehicle storage areas and conveyors in petrochemical and other hazardous industries; Oil stores in power plants; General lighting and storage areas for prefabricated goods in shipyards and docks; Regularly used stairs, basins and filters of clean water plants in water and sewage plants. In shipyards and docks, ( U_o ) may be 0,25</td>
</tr>
<tr>
<td>High risks i.e.</td>
<td>50</td>
<td>0,40</td>
<td>45</td>
<td>20</td>
<td>Element mould, timber and steel storage, building foundation hole and working areas on sides of the hole at building sites; Fire, explosion, poison and radiation risk areas in harbours, industrial yards and storage areas; Oil stores, cooling towers, boilers compressors, pumping plants, valves, manifolds, operating platforms, regularly used stairs, crossing points of conveyors, electric switch-yards in petrochemical and other hazardous industries; Switch yards in power plants; Crossing points of conveyors, fire risk areas in saw mills. At building sites and in saw mills, ( GR_L ) may be 50</td>
</tr>
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