EURO NCAP

#FORSAFERCARS

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Testing at low ambient light conditions

Crash Avoidance

Technical Bulletin CA 101

Implementation January 2026

PREFACE

DISCLAIMER: Euro NCAP has taken all reasonable care to ensure that the information published in this protocol is accurate and reflects the technical decisions taken by the organisation. In the unlikely event that this protocol contains a typographical error or any other inaccuracy, Euro NCAP reserves the right to make corrections and determine the assessment and subsequent result of the affected requirement(s).

CONTENTS

INTRODUCTION

This document outlines the verification conditions that must be followed by the Test Laboratory at the time of verifying the nighttime tests contained in the Euro NCAP Crash Avoidance Frontal Collisions assessment.

1 ILLUMINATION SITUATION

Based on a GIDAS hotspot analysis, this annex will describe a test condition for a night test scenario in urban situations.

1.1 Reference EN 13201

This European Standard defines performance requirements, which are specified as lighting classes for road lighting aiming at the visual needs of road users, and it considers environmental aspects of road lighting.

EN 13201, Road lighting is a series of documents that consists of the following parts:

— Part 1: Guidelines on selection of lighting classes [Technical Report];

— Part 2: Performance requirements [present document];

— Part 3: Calculation of performance;

— Part 4: Methods of measuring lighting performance;

— Part 5: Energy performance indicators.

1.2 Terms and definitions

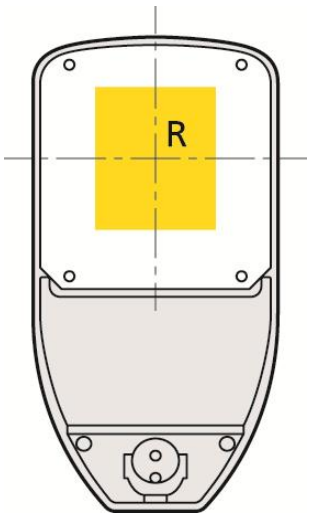
E - horizontal illuminance over a road area measured in lux (lx)

$\overline{Emin}$ - **horizontal illuminance averaged over a road area measured in lux (lx).**

$Emin$ - **lowest illuminance on a road area measured in lux (lx).**

$\overline{Emax}$ - **horizontal illuminance averaged over a road area measured in lux (lx).**

Reference point R **- The reference point of the lamp shall be the geometric centre of the light field**



1.2.1 Derivation of parameter

The test condition in this annex is based on accident analysis. The illumination values refer to DIN EN 13201.

The main illumination situations are main roads in urban situations with velocity 30...60 km/h, where main users are motorized vehicles and where bicycles and pedestrians are permitted.

The illuminance is based on class ME3. For ME3 comparative classes are available: C3 und S1. For Illuminance class S1 following values are defined in EN 13201:

Values for Class S1:

$\overline{Emin} > 15lx$ **AND** $Emin > 5lx$

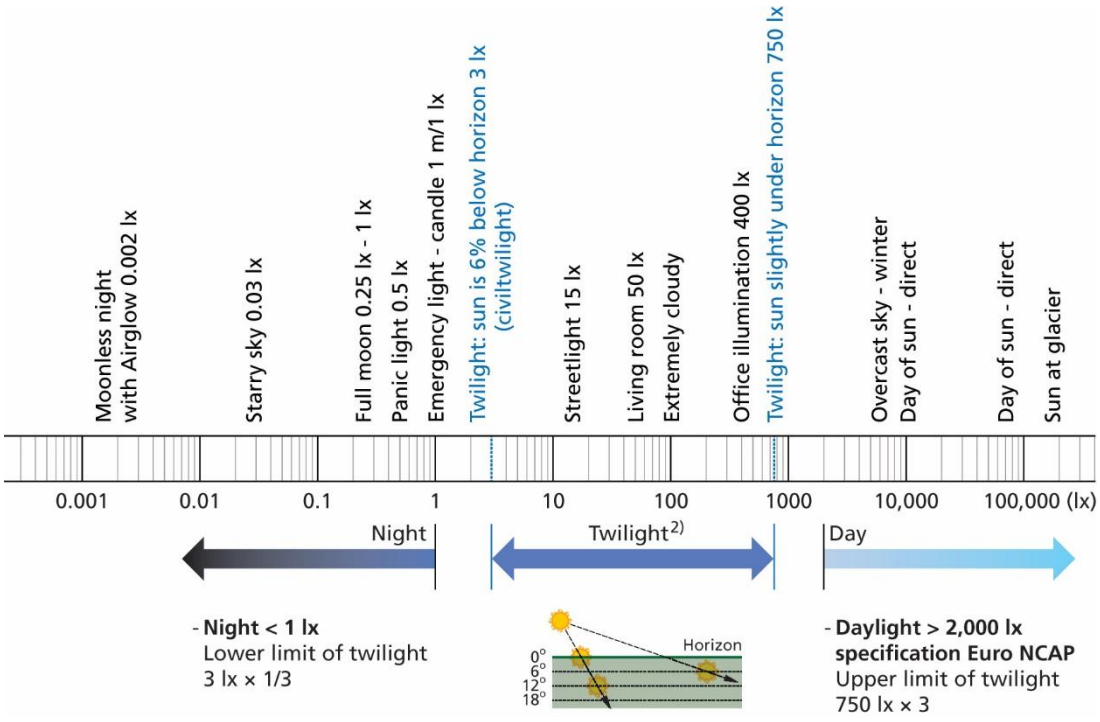
$\overline{Emax} < 1,5 * \overline{Emin}$ **AND** $\overline{Emax} < 22,5lx$

$\overline{Eref}$ **-** In order to reach a stable measurement setup, a reference value is defined as:

$\overline{Eref} = \frac{\overline{Emin}+\overline{Emax}}{2} = \frac{15lx+22,5lx}{2} = 18,75lx$

1.3 Light condition

There is a wide range of illuminance values in different situations. (see figure below).



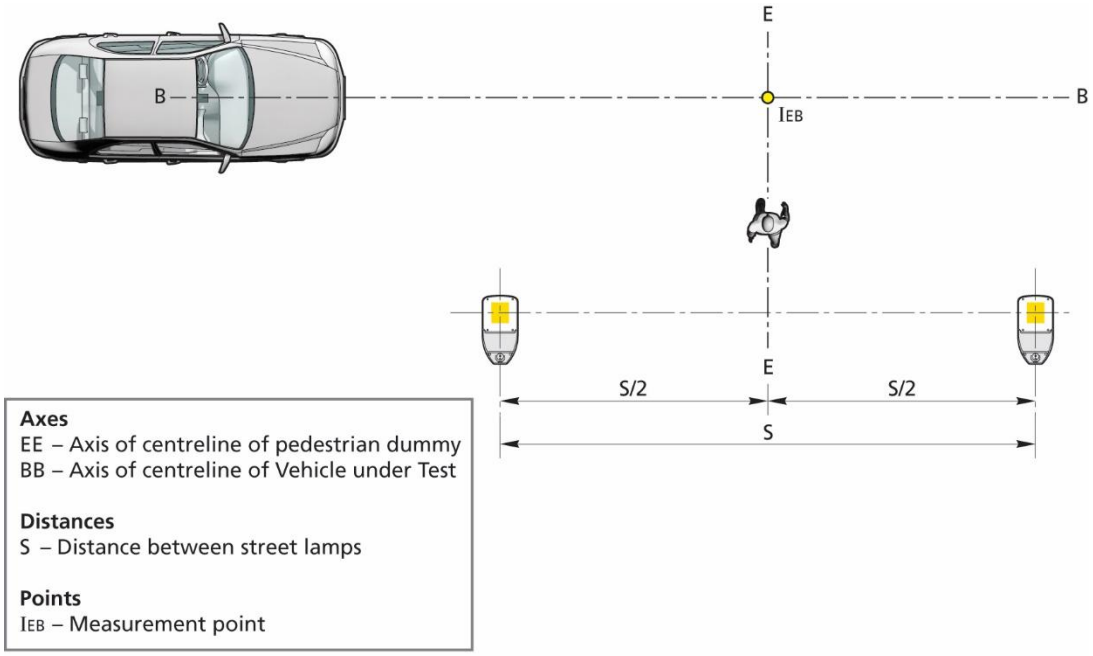
1.3.1 Background illuminance

The background illumination is an additive value to the streetlight illumination.

The position of the measurement of the background illumination shall be measured at the collision point. During measurement of background illumination all lamps and vehicle light shall be switched off.

Maximum of the background illumination on a test area during night shall be less than:

I_{EB} < 1lx



1.3.2 Illuminance at VUT path

The illuminance of VUT path ($\overline{I\,VUT}$) is defined as an average of illuminance measurement points along the VUT path, trajectory BB. For CPNA-25, CPNA-75 and CPNCO the average illuminance shall be in a range of:

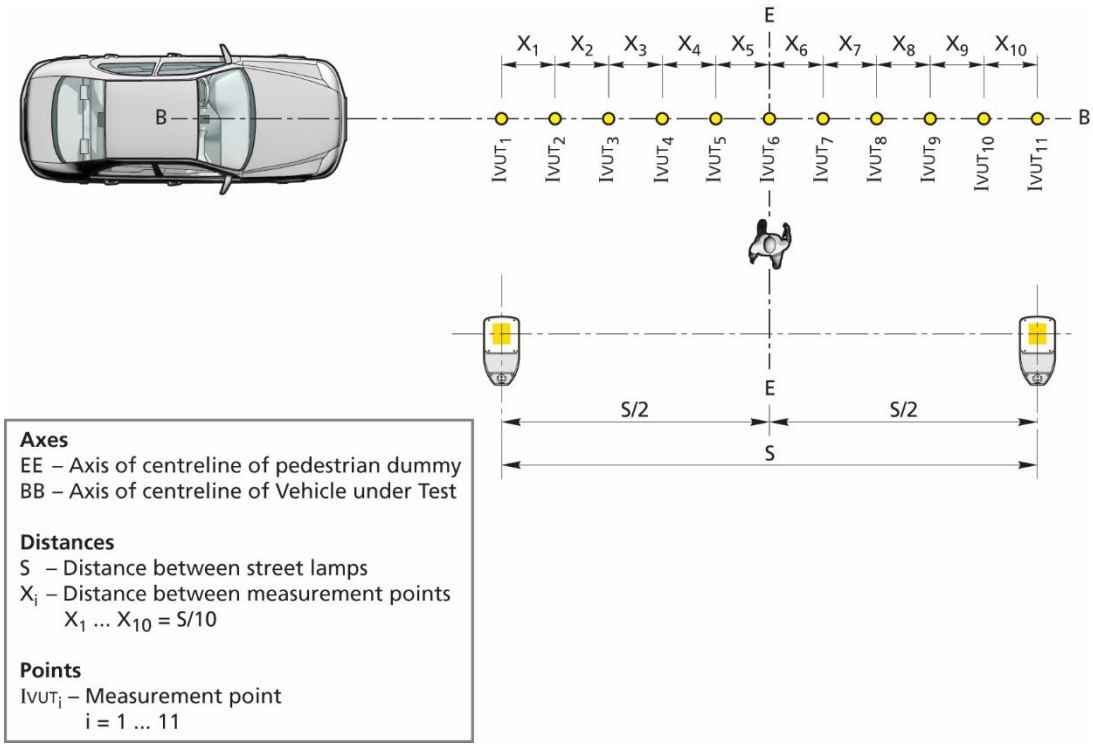
$$\overline{\boldsymbol{I\,VUT}} = \overline{Eref} \pm Tolerance = \mathbf{19}\boldsymbol{lx} \pm \mathbf{3}\boldsymbol{lx}$$

$$\overline{I\,VUT} = \frac{1}{11}\sum_{i=1}^{11} I\,VUTi; \qquad 16lx < \overline{I\,VUT} < 22lx$$

For CPFA, two additional lamps on the farside shall be switched on and the average illuminance shall be in a range of:

$$\overline{\boldsymbol{I\,VUT}} = \overline{Eref} \pm Tolerance = \mathbf{25}\boldsymbol{lx} \pm \mathbf{5}\boldsymbol{lx}$$

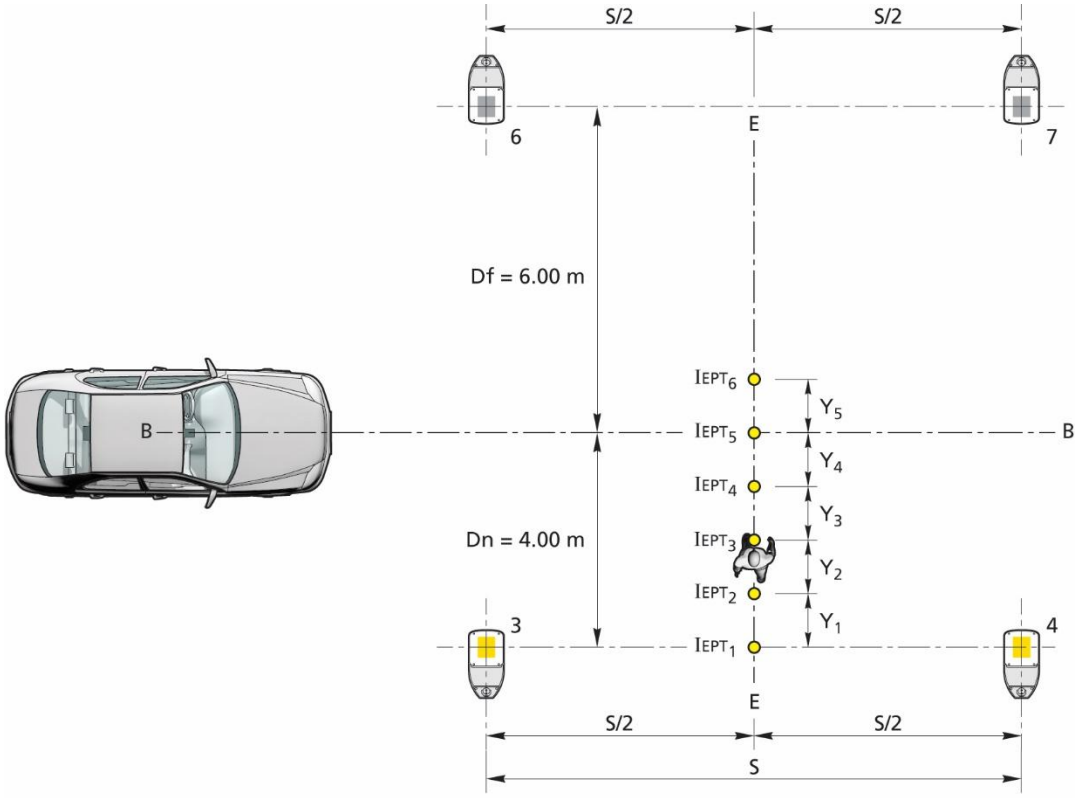
$$\overline{I\,VUT} = \frac{1}{11}\sum_{i=1}^{11} I\,VUTi; \qquad 20lx < \overline{I\,VUT} < 30lx$$



1.3.3 Illuminance at EPT path

The illuminance along the EPT path, trajectory EE shall be at least $I\,EPT_i > Emin$ $I\,EPT_i$ ranges from 1 to 6 in nearside scenarios (Figure B5), where street lamps 6 and 7 are switched off. $I\,EPT_i$ ranges from 4 to 11 in farside scenarios (Figure B6).

$I\,EPT_i$ > 5lx

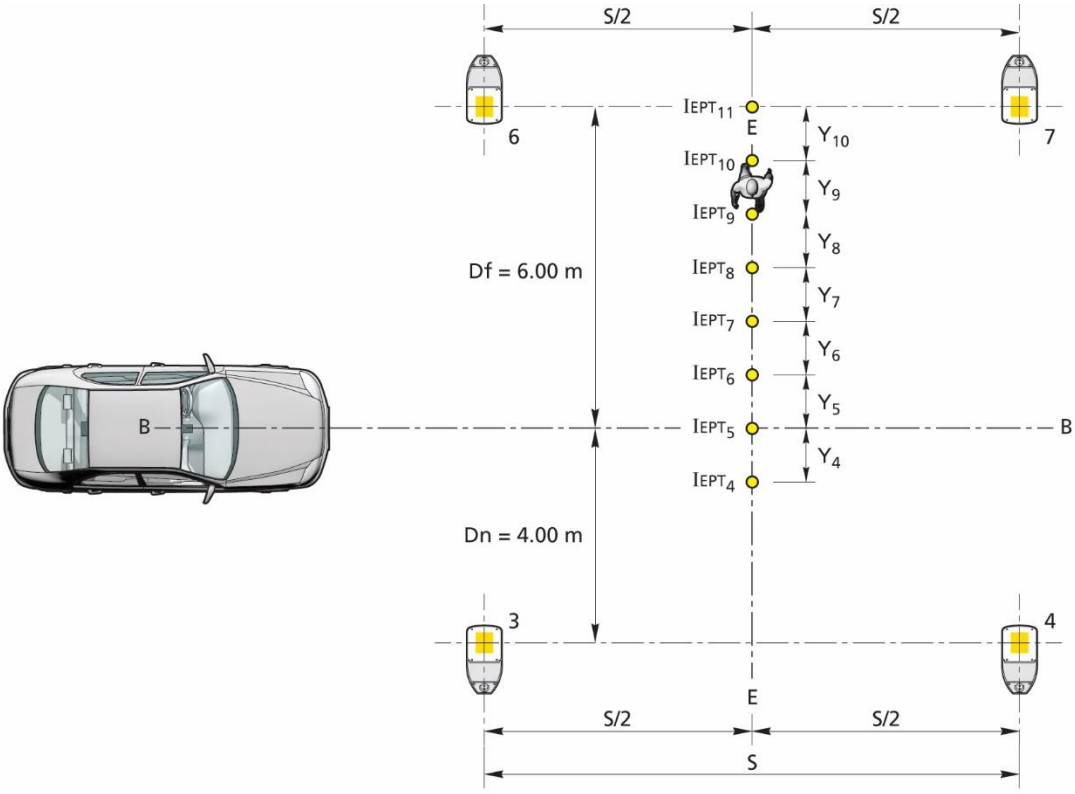


Axes
EE – Axis of centreline of pedestrian dummy
BB – Axis of centreline of Vehicle under Test

Distances
Dn – Lateral distance between the centre of the light field and the VUT path (nearside)
Df – Lateral distance between the centre of the light field and the VUT path (farside)
S – Distance between street lamps
Y_i – Distance between measurement points
Y_1 ... Y_5 = 1m

Points
$IEPT_i$ – Measurement point
i = 1 ... 6

Figure 1: Illuminance EPT path - nearside scenarios



Axes
EE – Axis of centreline of pedestrian dummy
BB – Axis of centreline of Vehicle under Test

Distances
Dn – Lateral distance between the centre of the light field and the VUT path (nearside)
Df – Lateral distance between the centre of the light field and the VUT path (farside)
S – Distance between street lamps
Y_i – Distance between measurement points
Y_4 ... Y_{10} = 1m

Points
$IEPT_i$ – Measurement point
i = 4 ... 11

Figure 1: Illuminance EPT path - farside scenarios

A.1.1 Measurement tolerances

All measurement tolerances shall be

E : ± 1lx

2 TEST EQUIPMENT

2.1 General requirement

The chosen lamp setup must reflect real world conditions. It is not allowed to install separate lamps to reach the required conditions. For the night test, a LED lamp shall be used due to its overall advantages like homogeneous illumination, long-term stability, power consumption etc.

2.2 Glaring

The lamps shall not be tilted towards the SV path to avoid any glaring which could affect the sensor performance. Glaring of the sensor system shall not occur everywhere on the test area and especially not along the section of the vehicle path.

2.3 Constant illumination function

To reach constant test conditions during test and lifetime, the lamp shall have a constant illumination function.

2.4 Colour temperature

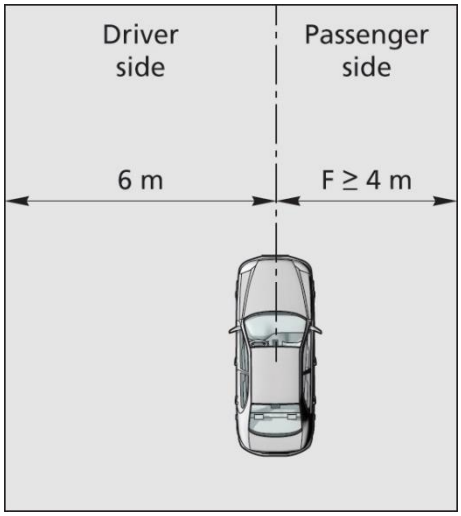
The colour temperature of the lamps shall be between 4500±1000K.

2.5 Mounting device

The lamps can be either installed stationary on a fixed pole, or on a mobile tripod. The mounting device must be designed to withstand wind speeds up to 20m/s.

2.6 Free Space (F)

In the passenger side of the VUT test path it is not allowed to install any mounting device from the lamp.



The free space F between the VUT path and the mounting facility shall be **F ≥ 4m.**

2.7 Test setup

Four lamps in front of the pedestrian path and three lamps behind the pedestrian path are required (see figure below). That lamp configuration provides a homogeneous illumination of the test scenario according to real world situations.

The position of the EPT is between lamp 3 and 4 (6 and 7 for CPFA).

Lamps 3, 4, 6 and 7 must be the same model lamp.

Lamps 6 and 7 are only switched on for the farside scenario.

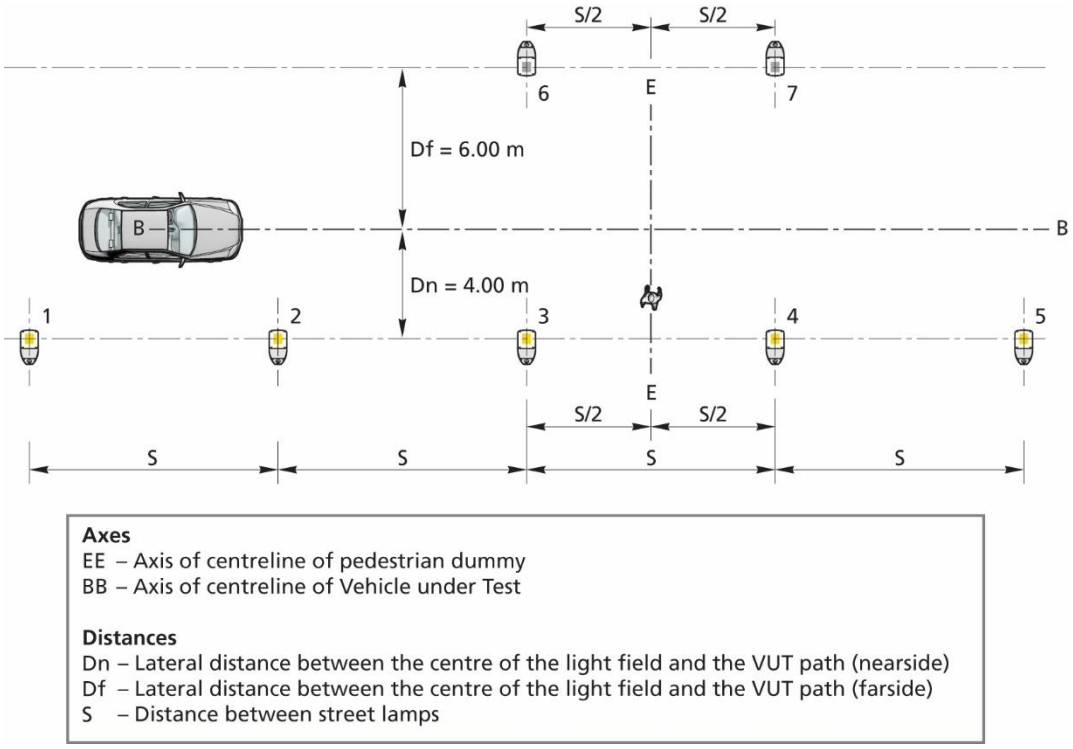


Figure B8: CPNA Night-time setup

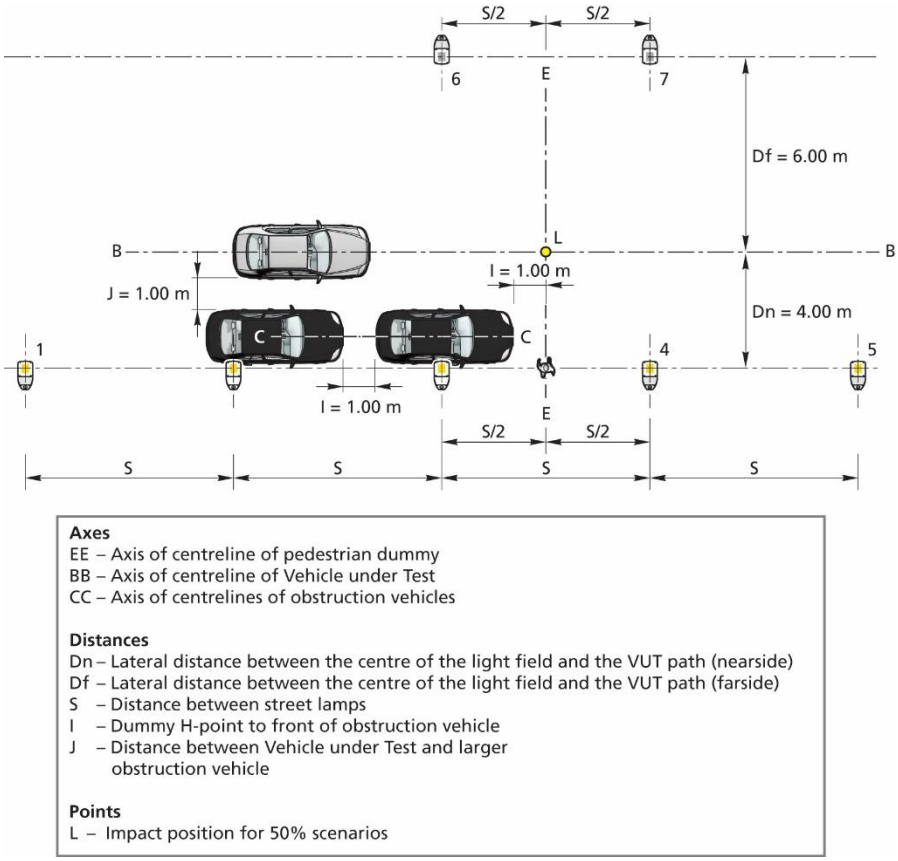


Figure B9: CPNCO Night-time setup

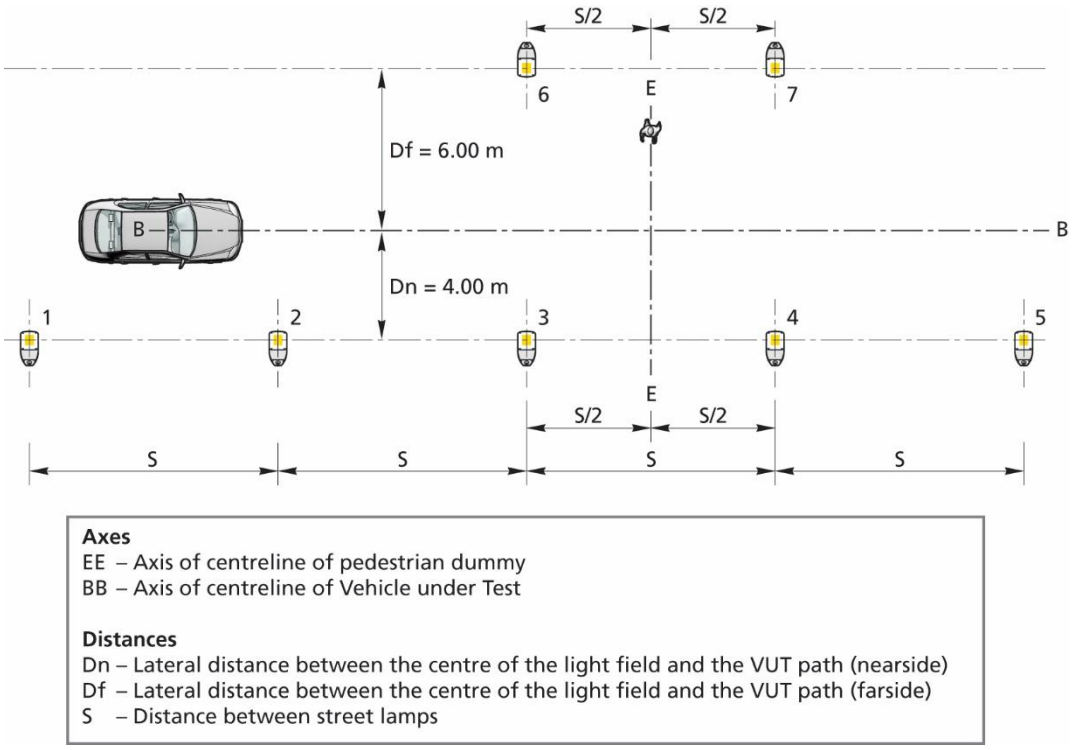
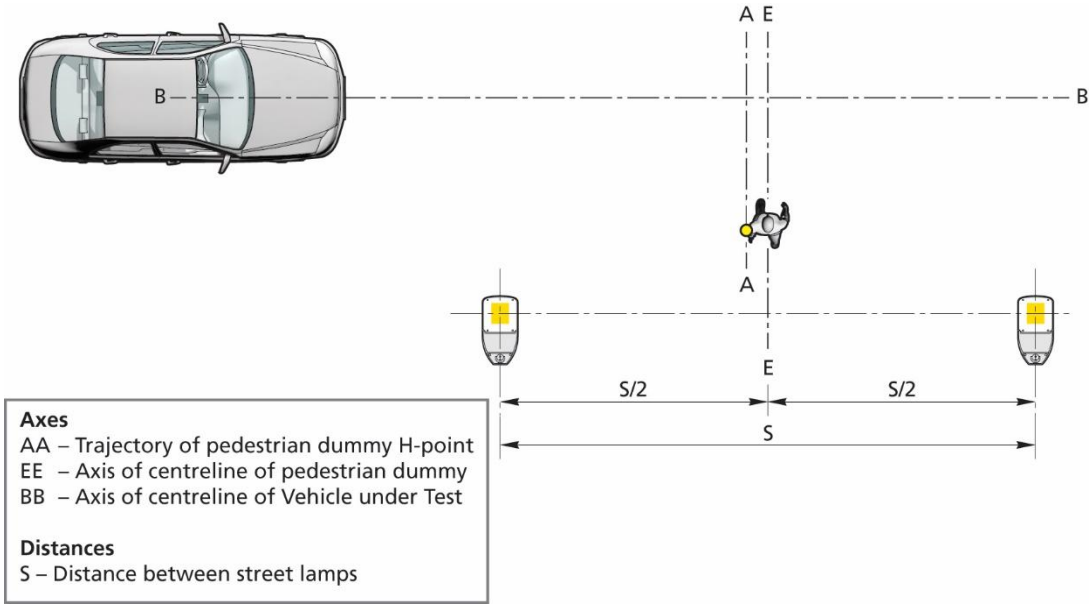


Figure B10: CPFA Night-time setup

2.8 EPT position

The EPT track EE shall be positioned between the street lamp 3 and 4 and passes the centreline of the EPT. Reference point for test setup is trajectory AA, which passes the pedestrian dummy H-point.



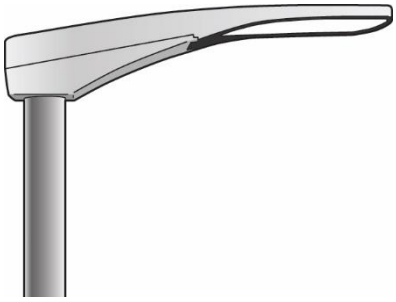
3 EXAMPLES OF TEST EQUIPMENT

As a reference and to demonstrate feasibility, the following sections provides example test equipment, test set-up and reference measurements that can be taken to ensure that the set-up will meet the requirements of this ANNEX.

Lamp type

Schuch, 48_LED (48 2403 ABX CL), or

Schuch, 47_LED (48 2403 ABX CL)



3.1 Requirement test setup adjustment

To be sure to reach requirement B4.2 and B4.3 the following parameters are allowed to be adjusted.

The distance of the lamp should be adjustable in order to reach the requested illumination values.

S: 25m ± 0,5m

The lateral distance between the centre of the LED-area and the vehicle path is adjustable in a range of

Dn: 4,0m ± 0,1m ; Df: 6,0m ± 0,1m

The height of the lamp should be adjustable in order to reach the requested illumination values.

H: 5m ± 0,1m

Angle against ground and pole.

α : 90° ± 0,5°

The tilt of the lamp is adjustable in three different positions. (0° standard, 5°, 10°)

T: 0° standard position

The inclination of road and test site surfaces is typically ~2.5%

γ: < 1,5°

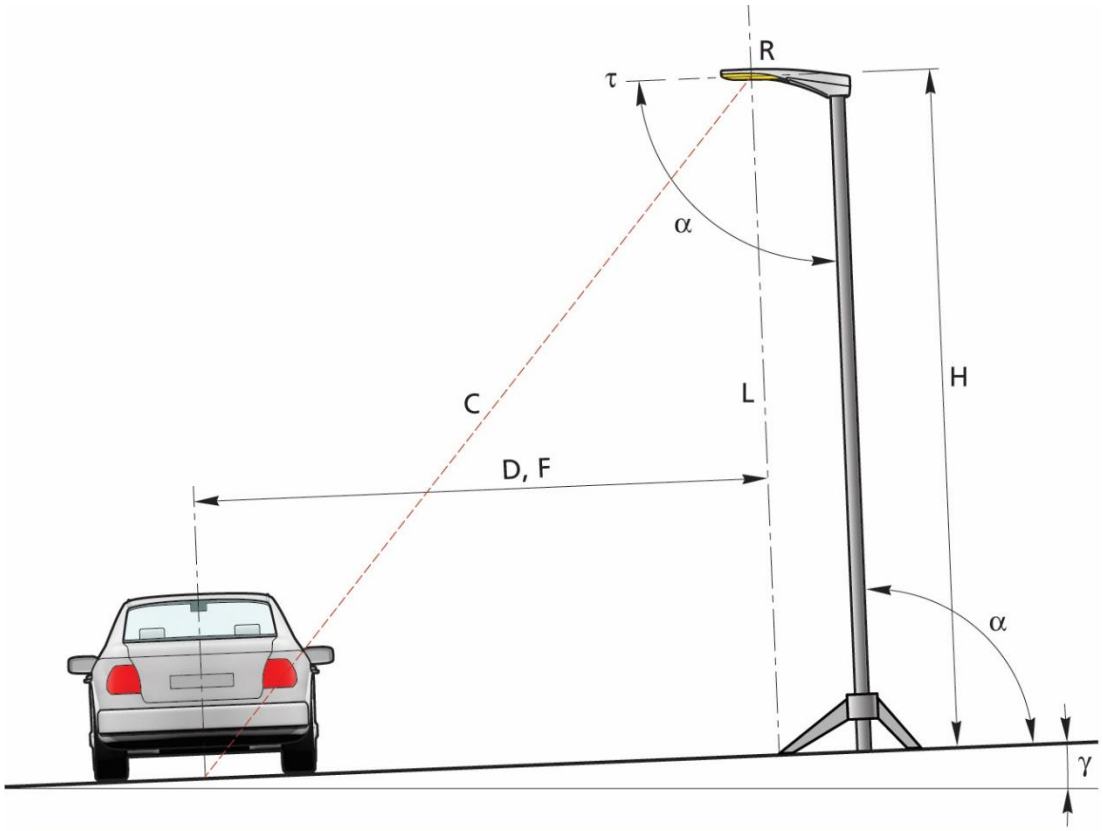
To ensure that the centre lines L of the lamps are oriented at right angles to the street even under the above conditions the length of the control line C (for both nearside Cn and farside Cf) shall be verified. Approval for the two lamps adjacent to the pedestrian path is sufficient:

$Cn = \sqrt{Dn^2 + H^2} = \sqrt{4m^2 + 5m^2}$

Cn: 6,4m ± 0,1m;

$Cf = \sqrt{Df^2 + H^2} = \sqrt{6m^2 + 5m^2}$

Cf: 7,8m ± 0,1m;

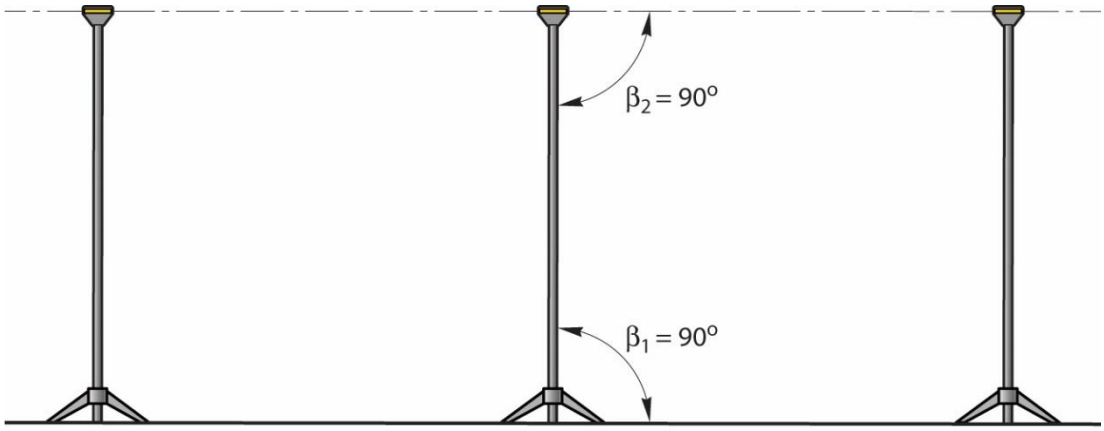


R – Reference point geometric centre of the light field
L – Centre line of the lamp (parallel to the pole)
D – Lateral distance between the centre of the light field and the VUT path
F – Free space between driving path of VUT and equipment
H – Height of lamp
C – Control line
τ – Tilt of lamp
α – Angle against ground and pole
γ – Cross slope

3.2 Longitudinal inclination of lamp

In order to get well balanced light distribution, it is necessary that the inclination of the lamp is in a range of:

β1,2: 90° ± 0.5°

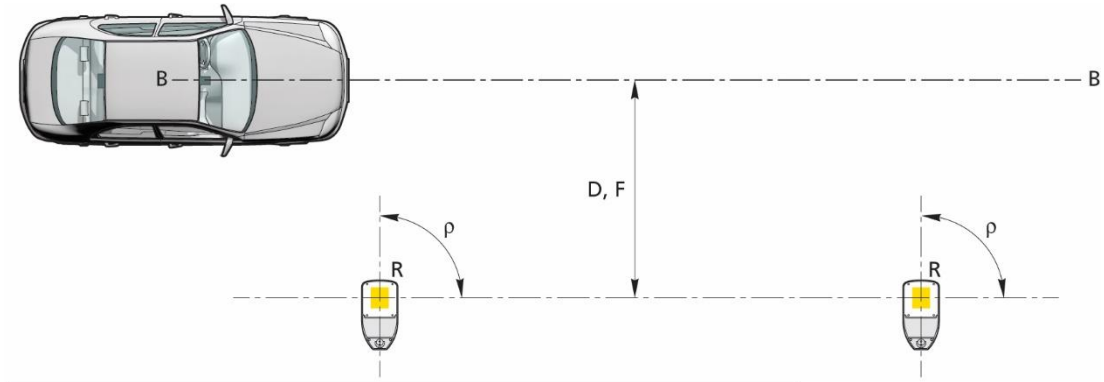


β_1 – Inclination of lamp to ground
β_2 – Inclination of lamp to pole

3.3 Orientation of lamp

In order to get well balanced light distribution, it is necessary that the rotation of the lamp in a range of:

ρ: 90° ± 0,1°



Axes
BB – Axis of centreline of Vehicle under Test

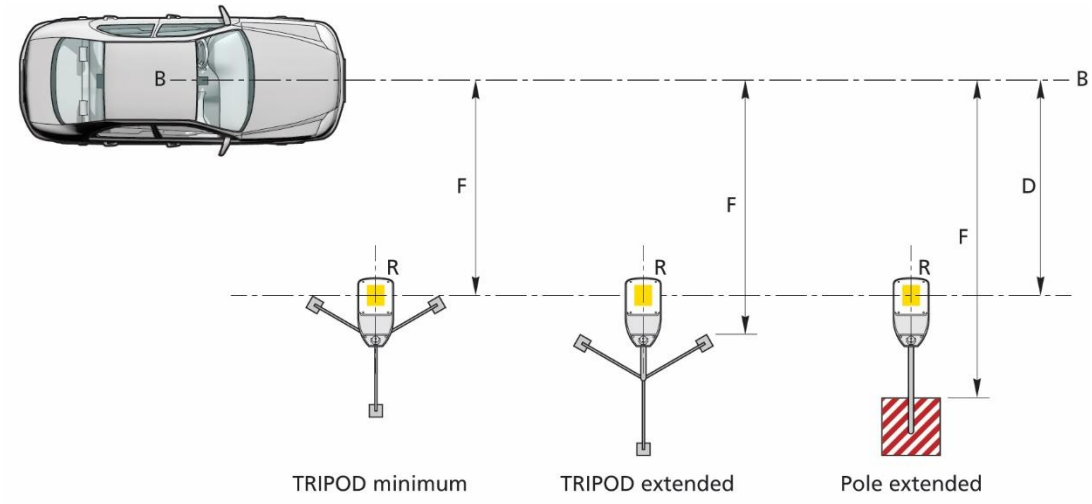
Angles
ρ – rotation of lamp

Distances
F – Free space between driving path of VUT and equipment
D – Lateral distance between the centre og the light field and the VUT path

Points
R – Reference point geometric centre of the light field

3.4 Example solutions

It is not allowed to install any mounting device within the free space. Different solutions are possible to reach the requirement as defined in B5.6.



Axes
BB – Axis of centreline of Vehicle under Test

Distances
F – Free space between driving path of VUT and equipment
D – Lateral distance between the centre og the light field and the VUT path

Points
R – Reference point geometric centre of the light field

3.5 Example mounting devices

It is not allowed to install any mounting device within the free space. Different solutions are possible to reach the requirement as defined in B5.6.

Towerlight TF5.5

http://www.towerlight.de/produkt/tf-5-5-7m/

(Date 2017-05-15)

configuration tripod

configuration cement pole

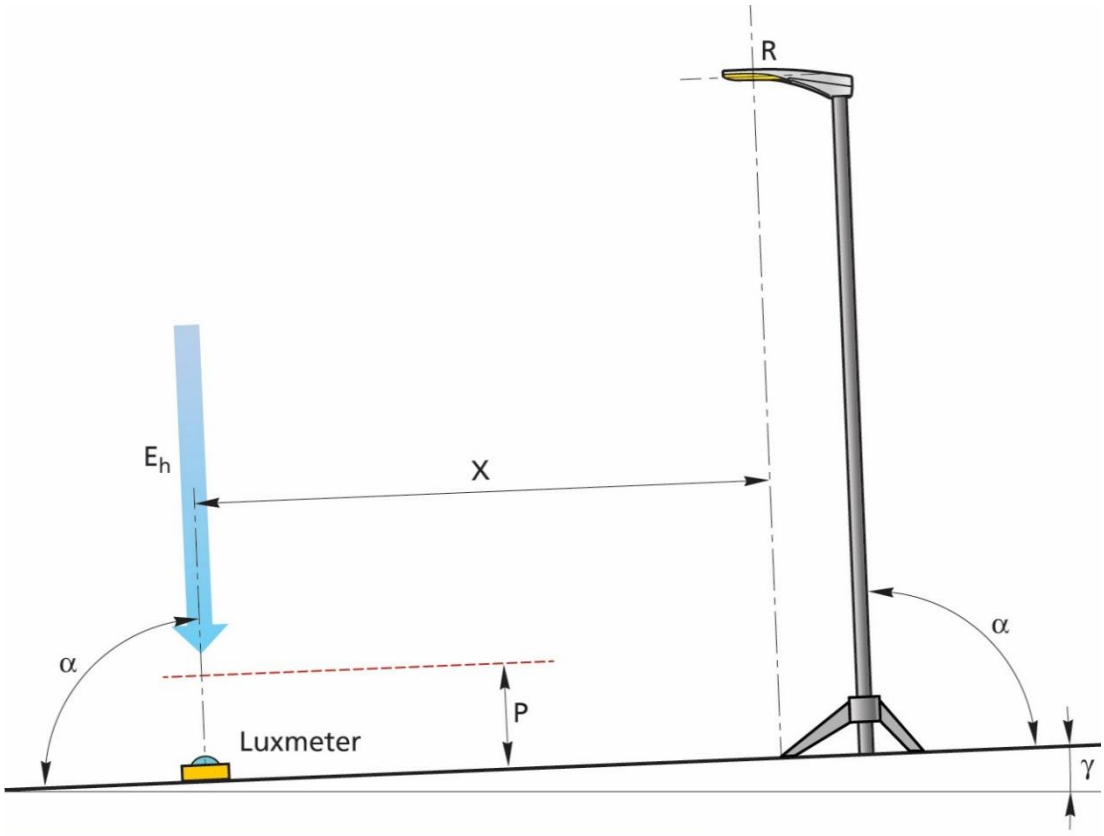
4 MEASUREMENT

To ensure, that the parameter defined in B4.1, B4.2 and B4.3 are in line with test setup, the parameter must be verified and documented.

4.1 Measurement setting

To measure the illumination, a calibrated luxmeter must be set on ground in a right angle to the street.

P: < 0,2m



E_h– Horizontal illumination
R – Reference point geometric centre of light field
P – Maximal height over ground
X – Position X
α – Angle against ground
γ – Cross slope

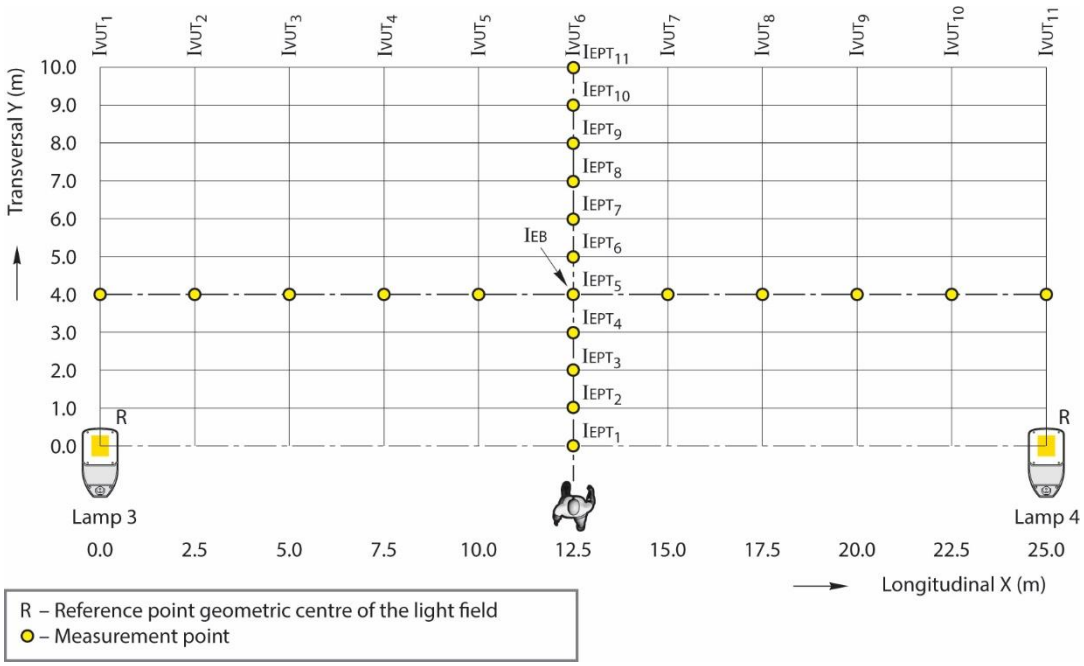
4.2 Example measurement grid

To ensure, that the parameter defined in B4.1, B4.2 and B4.3 are in line with test setup, the parameter must be verified and documented.

For I EPT5, I VUT6, I EB the position for measurement is:

X=12,5m, Y=4,0m.

The other values see figure below.



4.3 Example measurement tools

To measure the illuminance values, a calibrated luxmeter shall be used. The tolerance shall be:

Maximal error tolerance < 5%.

Luxmeter LMT B 360

http://www.lmt-berlin.de/de/b360.html

(Date 2017-05-15)

Luxmeter LMT B 360

Luxmeter Konika T-10A

https://www.konicaminolta.eu/de/messgeraete/produkte/licht-messtechnik/luxmeter/t-10a/einfuehrung.html
(Date 2017-05-15)

figure: Luxmeter Konika T-10A

4.4 Measurement documentation

The following values shall be measured and documented before and after a complete test series.

- **Background illuminance I_{EB} (1.3.1)**

With all lamps and vehicle lights switched OFF, measure and record **I_{EB}** before and after a full test series.

- **Illuminance at VUT, EPT path (1.3.2 & 1.3.3)**
  With all lamps ON and vehicle lights OFF, measure and record the illuminance at VUT and EPT path.