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INTERNATIONAL COMMISSION ON ILLUMINATION
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TECHNICAL REPORT

**ROAD LIGHTING LANTERN AND
INSTALLATION DATA - PHOTOMETRICS,
CLASSIFICATION AND PERFORMANCE**

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A - 1030 VIENNA, Kegelgasse 27 - AUSTRIA

C.I.E. TECHNICAL COMMITTEE REPORTPRELIMINARY REMARK

This report has been prepared by CIE Technical Committee 4.6 "Road Lighting". It has been approved unanimously by the Committee and is recommended for study and application. This report is not an Officially Agreed CIE Recommendation approved by the National Committees of the Member Countries. It should be noted that any recommendations in this report are advisory and not mandatory.

NOTE PRELIMINAIRE

Ce rapport a été préparé par le Comité Technique CIE 4.6 "Eclairage des voies publiques". Il a reçu l'approbation unanime du Comité, et il est recommandé pour étude et application.

Ce rapport n'est pas une Recommandation officielle de la CIE approuvée par les Comité Nationaux des Pays Membres. Il doit être noté que toute recommandation y figurant est donnée à titre de conseil et non d'obligation.

VORBEMERKUNG

Dieser Bericht wurde vom Technischen CIE-Komitee 4.6 "Strassenbeleuchtung" ausgearbeitet. Er wurde uneingeschränkt vom Komitee angenommen und wird zum zukünftigen Studium empfohlen. Er ist keine Offiziell Anerkannte CIE-Empfehlung, die von den Nationalen Komitees der Mitgliedsländer anerkannt wurde. Es muss darauf hingewiesen werden, dass alle Empfehlungen dieses Berichts nur als Anleitung dienen und nicht verbindlich sind.

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CONSULTANTS

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E. Müller	Switzerland
J. Renaud	France
J. Vermeulen	Netherlands
H.O. Westermann	Netherlands

SUMMARY

This technical report is one of a series of supporting documents to Publication CIE No. 12.2 (TC-4.6) 1977 "Recommendations for the lighting of roads for motorized traffic". It is concerned with the data involved in predicting the performance of an installation, as described in Publication CIE No. 30 (TC-4.6) 1976 "Calculation and Measurement of Luminance and Illuminance in Road Lighting".

The report consists of three parts. Part 1 describes the preferred form of basic photometric data for road lighting lanterns: - intensity tables, isocandela diagrams, polar diagrams, flashed areas. Part 2 outlines additional derived data for an individual lantern which could be of value: - the description of a lantern (in terms of throw, spread and control), utilization factor diagrams, luminance yield diagrams, isoluminance diagrams. Part 3 gives three useful methods of presenting data on the performance of an installation of lanterns: - performance tables, performance graphs, layout tables for achieving a specific performance. An appendix gives some information on the differences in performance which have been found between installations using lanterns satisfying the same specification or classification.

RESUMELUMINAIRE POUR ECLAIRAGE ROUTIER ET CARACTERISTIQUES DES INSTALLATIONS.

Ce rapport technique est un de ceux destinés à compléter la "Publication n° 12.2 - C I E (T C 4.6.) 1977 " et intitulée :

"RECOMMANDATIONS POUR L'ECLAIRAGE DES ROUTES DESTINEES AU
TRAFFIC MOTORISE "

Il doit être mis en corrélation avec les données intervenant dans la prévision des performances d'une installation, ainsi que cela est décrit dans la "Publication C I E n° 30 (T C 4.6.) 1976" :

"CALCUL ET MESURE DES LUMINANCES ET DES ECLAIREMENTS EN
ECLAIRAGE PUBLIC "

Le rapport est divisé en 3 parties :

- la première partie décrit les méthodes préférentielles de présentation des données photométriques de base des luminaires pour éclairage public :
 - tables d'intensité lumineuse;
 - diagrammes isocandelas ;
 - diagrammes polaires ;
 - surfaces éclairantes .
- la deuxième partie définit, pour une lanterne individuelle, des grandeurs dérivées additionnelles, qui peuvent présenter un intérêt :
 - classification du luminaire (en termes d'extensivités longitudinale et transversale et du contrôle de l'éblouissement);

- diagrammes des facteurs d'utilisation ;
 - diagrammes des rendements en luminance;
 - diagrammes isoluminance .
- la troisième partie décrit 3 méthodes pratiques de présentation des données relatives aux performances obtenues par un système de luminaires dans une installation :
- tables de performances ;
 - graphiques de performances ;
 - tables donnant les caractéristiques géométriques à respecter en installations, en vue d'obtenir des performances données.

Une annexe contient des informations quant aux différences obtenues dans les performances qui ont été trouvées dans diverses installations utilisant des luminaires différents, mais qui appartiennent à la même classe dans le système de classification proposé.

ZUSAMMENFASSUNG

Dieser Technische Bericht gehört zu eine ganzen Reihe von Dokumenten, welche die Publikation CIE Nr. 12.2 (TC-4.6) 1977 "Empfehlungen für die Belouchtung von Strassen für den motorisierten Verkehr" ergänzen. Er behandelt die Daten, die für die Eigenschaften einer Beleuchtungsanlage von Bedeutung sind, wie sie in der Publikation CIE Nr. 30 (TC-4.6) 1976 "Berechnung und Messung der Leuchtdichte und Beleuchtungsstärke in der Strassenbeleuchtung" beschrieben werden.

Der Bericht besteht aus drei Teilen. Teil 1 gibt die bevorzugte Form an, in der die wichtigsten lichttechnischen Daten von Leuchten für Strassenbeleuchtung dargestellt werden sollten: Lichtstärketabellen, Isocandela-Diagramme, Lichtstärkeverteilungen in Polarkoordinaten, gesehene Leuchtenfläche.

Teil 2 befasst sich mit weiteren abgeleiteten Daten für einzelne Leuchten: Leuchtenklassifizierung (Längs- und Breitstrahlung, spezifischer Leuchtenindex), Wirkungsgraddiagramme, Diagramme der Leuchtdichteausbeute, Iso-Leuchtdichtediagramme.

Teil 3 stellt drei zweckmässige Verfahren dar, die Anlagedaten für bestimmte Leuchtentypen anzugeben: Tabellen oder Diagramme der Eigenschaften von Strassenbeleuchtungsanlagen, Tabellen mit Angaben über die Anlagengeometrie mit der vorgegebene Anlagedaten erzielt werden. Ein Anhang gibt einige Informationen über Unterschiede von Anlagedaten, die sich in Anlagen ergeben, die mit Leuchten jeweils gleicher Spezifikation oder Klassenzugehörigkeit ausgerüstet sind.

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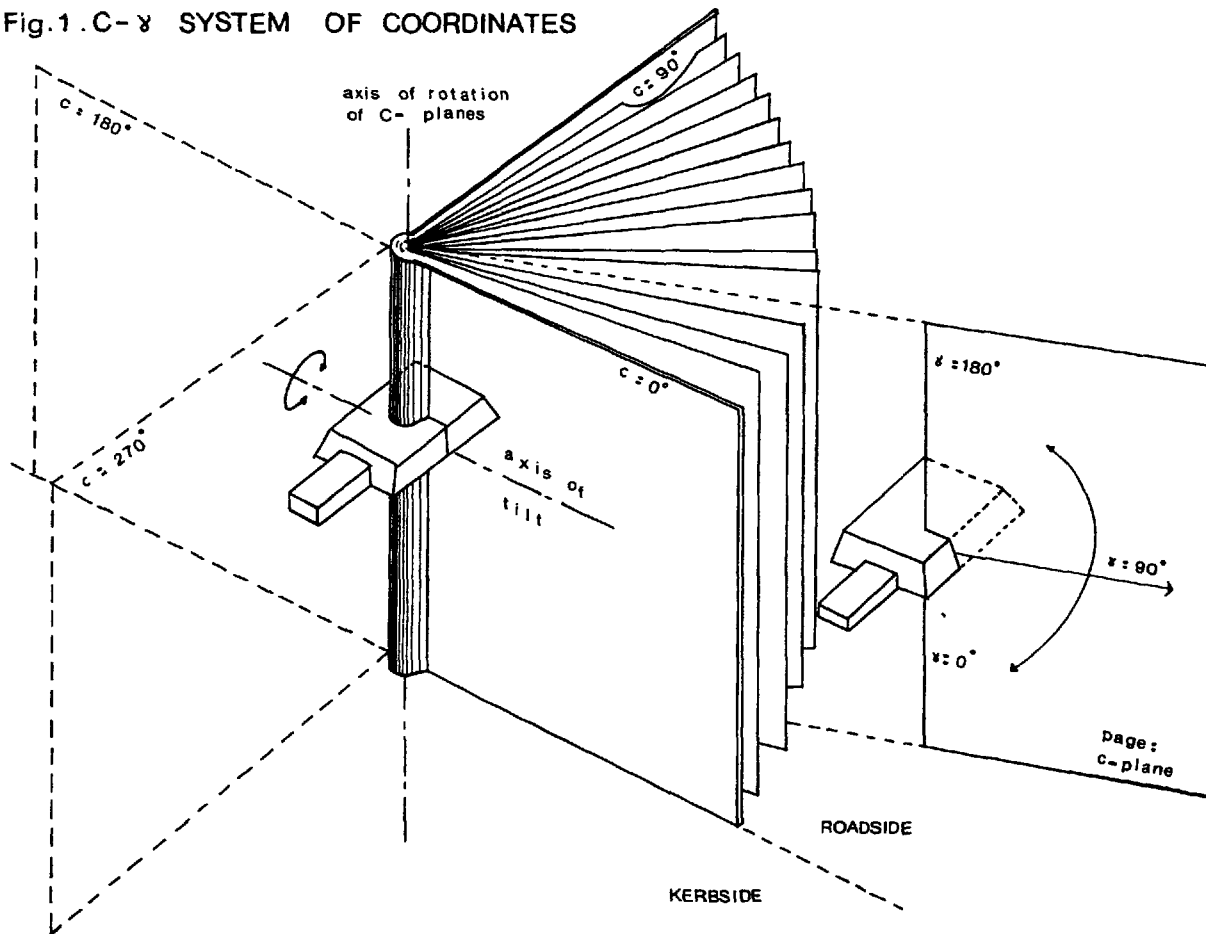
INTRODUCTION

This technical report is one of a number of CIE publications which are concerned with road lighting, the fundamental document being Publication CIE No. 12.2 TC-4.6) 1977 "Recommendations for the lighting of roads for motorized traffic." In addition to reviewing the principles of road lighting, Publication CIE No. 12.2 gives quantitative recommendations for the performance of road lighting installations - the level and uniformity of roadway luminance to be achieved, the control of discomfort and disability glare to be exercised. Installation performance depends on the intensity distribution of the lanterns used, on the geometry of the installation and on the reflection properties of the road surface. How the intensity distribution of a lantern should be measured is detailed in Publication CIE No. 27 (TC-2.4) 1973 "Photometry of luminaires for street lighting", and how the performance of an installation should be predicted is described in Publication CIE No. 30 (TC-4.6) 1976 "Calculation and measurement of luminance and illuminance in road lighting."

The object of this technical report is to supplement the three publications referred to above by advising on the way both lantern data and installation performance data can best be presented to be of use to the road lighting engineer.

A method of classifying lanterns is introduced, purely to enable a type of lantern to be described. This classification is intended to fill the vacuum left by the withdrawal from Publication CIE No. 12.2 of the lantern intensity distribution specifications used in 1965, the titles of which have hitherto been used for descriptive purposes.

The report consists of three parts. Part 1 is concerned with the basic photometric data for lanterns, data which should be provided by every manufacturer, essentially the distribution of luminous intensity and the flashed area. Part 2 deals with the presentation of data for an individual lantern which is derived from this basic information, the lantern classification and the distribution of illuminance and luminance it provides. Part 3 gives three alternative methods of showing how an array of lanterns will perform, i.e. installation performance data.

Fig.1. C- γ SYSTEM OF COORDINATES

γ	270	285	300	315	330	345	360	5	10	15	20	25	30	35	40	45	50	60	75	90
0	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194	194
10	188	188	187	188	189	190	190	191	190	191	192	193	193	193	195	195	194	194	193	193
20	177	177	179	182	184	187	188	191	191	192	194	197	198	200	200	199	202	203	198	196
30	160	163	168	173	178	181	185	188	192	194	200	204	206	214	212	212	214	211	207	203
35	150	154	160	167	171	176	180	183	189	195	201	209	212	215	216	215	215	211	207	200
40	139	144	152	159	164	170	176	180	187	193	198	204	207	210	215	223	227	220	210	196
45	125	134	146	155	157	160	165	171	178	186	193	200	210	225	226	230	238	238	219	201
47.5	115	123	137	145	151	159	163	169	178	191	196	201	215	238	235	248	257	259	235	205
50	106	114	127	136	142	149	157	166	176	188	198	210	221	235	248	258	284	280	252	211
52.5	98	106	120	129	135	142	151	162	173	187	200	215	231	240	250	279	309	300	258	217
55	90	99	113	121	128	135	143	155	166	180	197	215	236	246	270	303	334	319	274	223
57.5	82	93	104	114	120	128	133	139	153	166	184	210	241	255	276	325	352	331	274	225
60	75	84	96	106	110	117	120	126	140	155	175	207	250	263	293	340	364	343	282	225
62.5	68	76	88	97	101	107	110	116	128	145	168	199	254	267	302	348	381	351	282	223
65	62	69	80	90	94	99	104	110	121	139	157	190	218	257	300	359	393	346	284	222
67.5	53	63	73	83	87	92	96	102	115	134	152	179	210	247	294	348	350	330	277	227
70	36	47	67	74	78	82	89	91	104	126	150	177	204	241	276	324	343	306	260	215
72.5	10	29	50	59	65	71	74	77	93	115	142	168	190	219	261	312	320	276	231	188
75	5	8	19	29	36	43	47	52	66	97	128	151	160	168	210	279	275	187	162	144
77.5	2	4	6	7	9	11	12	12	20	39	60	82	80	77	110	188	124	46	51	86
80	0	1	3	4	4	5	6	6	7	7	8	11	12	13	20	85	13	6	8	27
82.5	0	0	0	0	0	0	1	1	1	2	2	2	2	2	4	13	5	3	4	5
85	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	4	2	0	1	2
87.5	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	2	1	1	0	0
90=180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIG. 2. I - table (values in cd/km)

PART 1. LANTERN PHOTOMETRIC DATA

The basic photometric data of a lantern consists of a set of luminous intensity values in different directions, derived from measurements on a distribution photometer (goniophotometer). The coordinate system to be used and the directions in which luminous intensity values are required are specified in Publication CIE No. 27 (TC-2.4) 1973

"Photometry of luminaires for street lighting." These specifications are reproduced in this part of this report, together with methods for displaying the information graphically. Also, since the flashed area of a lantern is necessary for calculating the discomfort glare from a road lighting installation, the method of obtaining this is included.

1.1. Coordinate system

The coordinate system used for defining the space around a road lantern is known as the C-gamma system and is shown in Fig. 1.

The centre of the coordinate system coincides with the centre of the optical system of the lantern. The vertical axis of the system is formed by the perpendicular line dropped from the centre of the lantern to the horizontal plane to be illuminated, independent of any lantern tilt. Vertical half-planes rotate around this axis. The half-planes parallel to the longitudinal roadway axis are defined by the angles $C = 0$ and $C = 180^\circ$. The half-planes perpendicular to the road axis are defined by the angles $C = 90^\circ$ on the road side and $C = 270^\circ$ on the kerb side. The elevation angles in these planes are indicated by γ , increasing from vertically downwards $\gamma = 0$ to vertically upwards $\gamma = 180^\circ$. Every direction is clearly defined by values of C and γ .

Despite the unambiguous definitions of C- and γ - angles, it is advisable for a manufacturer to include in any photometric data a sketch of the lantern identifying the angles used in the data.

1.2. Distribution of luminous intensity

When computers are used for calculating road lighting installation performance, the distribution of luminous intensity of the lanterns used has to be supplied in the form of tables. A graphical method of displaying the intensity distribution is however preferable for non-computer use, and this may take the form of either (a) a set of isocandela contours on a diagram which represents the space around the lantern, or (b) polar graphs of intensity in specific planes.

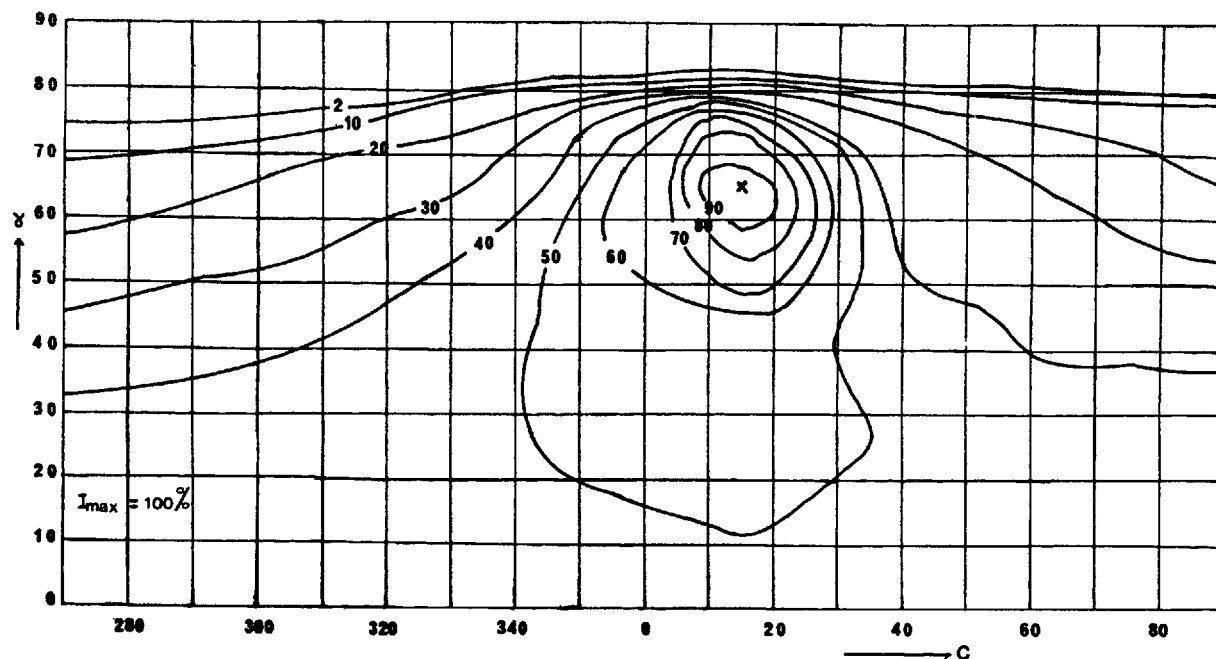


Fig. 3. Isocandela diagram on rectangular web

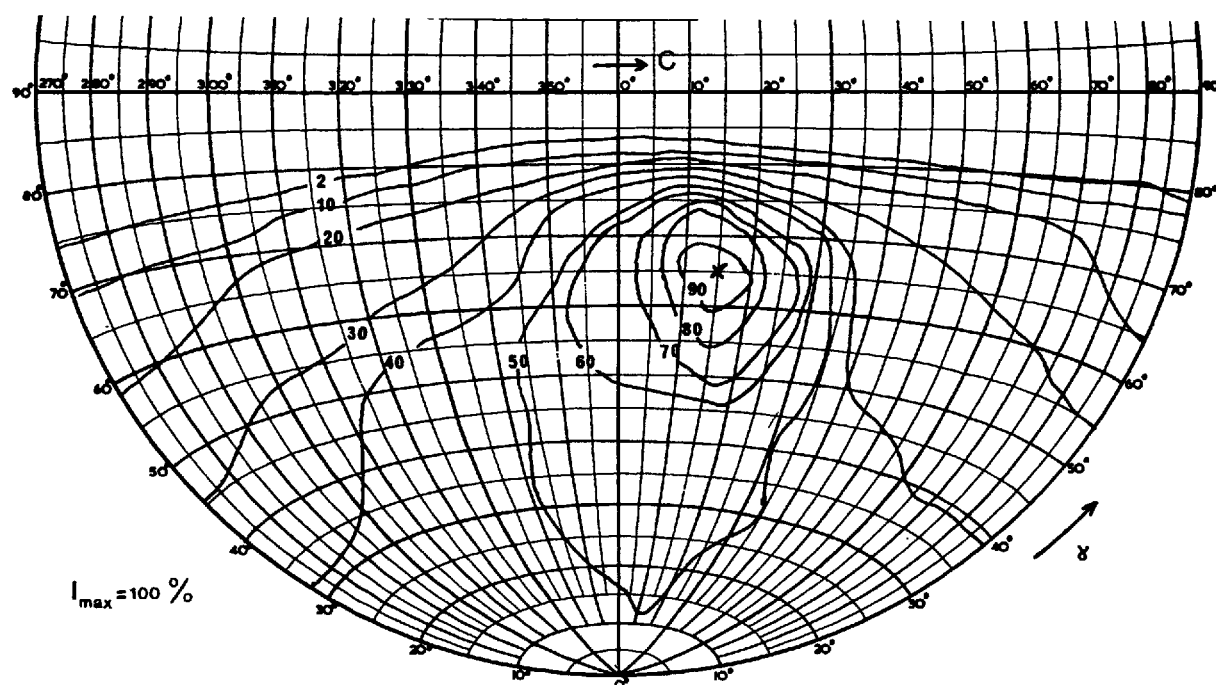


Fig. 4. Isocandela diagram on circular web