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TECHNICAL REPORT

DEPRECIATION OF INSTALLATIONS AND THEIR MAINTENANCE

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RAPPORT DE COMITE TECHNIQUE DE LA CIENOTE 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 Comités Nationaux des Pays Membres. Il doit être noté que toute recommandation y figurant est donnée à titre de conseil et non d'obligation.

PRELIMINARY 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.

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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T.H. Tan	Netherlands

SUMMARY

The first part of this report gives a survey of all the permanent or accidental causes which conspire progressively to impair the performance of a road lighting installation.

It then points out what preventive measures can be taken when the system is designed and installed to reduce or slow down the different deteriorations of the material (columns, lanterns, light sources, auxiliary gear).

In the last part, it indicates all the periodic operations aimed at protecting the materials against the causes of depreciation, or at retrieving, as much as possible, the initial performance of the installation. The different methods of maintenance and of replacement of the various items are analysed.

Special paragraphs deal with installations of specific nature, such as viaducts, elevated roads, high mast lighting, tunnels.

RESUME

Ce rapport passe d'abord en revue toutes les causes permanentes ou accidentielles qui concourent à réduire progressivement les performances d'une installation d'éclairage public.

Il indique ensuite par quelles mesures préventives prises lors de la conception et de la réalisation d'une installation il est possible d'atténuer ou de ralentir les diverses détériorations des matériels utilisés (supports, luminaires, sources lumineuses, appareillages auxiliaires).

Dans une dernière partie, il indique toutes les opérations périodiques qui ont pour objet de mettre les matériels à l'abri des causes de détérioration, ou de rendre, dans la mesure du possible, à l'installation d'éclairage, son efficacité initiale. Les diverses méthodes d'entretiens et de remplacement des diverses pièces sont analysées.

Des paragraphes spéciaux sont consacrés aux installations de caractère particulier (viaducs, chaussées surélevées, pylones de grande hauteur, tunnels).

ZUSAMMENFASSUNG

Der erste Teil dieses Berichtes gibt eine Übersicht über die ständigen und zufälligen Ursachen der allmählichen Verschlechterung in der Funktion von Straßenbeleuchtungsanlagen.

Danach werden Vorsorgemaßnahmen angegeben, durch die nach der Planung und Ausführung der Anlage die Alterungserscheinungen der Einzelteile (Maste, Leuchten, Lampen, zusätzliches Zubehör) verringert oder völlig vermieden werden können.

Im letzten Teil werden alle periodischen Wartungsarbeiten genannt, die darauf abzielen, das Material gegen die Ursachen der Verschlechterung zu schützen oder soweit wie möglich die Anfangsleistung der Anlage wiederherzustellen. Die unterschiedlichen Methoden der Wartung und des Auswechselns verschiedener Teile werden analysiert.

Sonderanlagen wie Überführungen, Hochstraßen, Hochmastanlagen und Tunnel werden in gesonderten Abschnitten behandelt.

TABLE OF CONTENTS

INTRODUCTION :	Purpose of the present report	7
1.	DEPRECIATION OF INSTALLATIONS	7
2.	MAINTENANCE OF INSTALLATIONS	13
3.	DEPRECIATION AND MAINTENANCE OF LIGHTING INSTALLATIONS IN TUNNELS	23

INTRODUCTION : Purpose of the present report

The present technical Report must be considered as an annex to C.I.E. documents on road lighting. Its aim is to review and analyse the different causes of deterioration and depreciation of public lighting installations, and to draw conclusions regarding :

- on one hand, what characteristics should be required from new materials employed.
- on the other hand, what are the most convenient methods to maintain different categories of installations.

1. DEPRECIATION OF INSTALLATIONS

The characteristics of a public lighting installation, and hence also the performance, deteriorate with time through the influence of a number of causes, of which the principal are :

- a) Progressive reduction in the flux emitted by the light sources
- b) Accumulation of dirt on the sources.
- c) Ageing of the components (reflectors, refractors, etc ..)
- d) Accumulation of dirt on the optical parts of the lantern
- e) Premature failure of one of the sources.
- f) Vibrations imposed on the material and distortion caused by accidents.

In addition to that, there is a certain number of possible causes of decrease of the efficiency, which do not take effect cumulatively :

- g) Excessive raising or lowering of the temperature inside the lantern.
- h) Premature failure of the auxiliary apparatus.
- i) Incorrect voltage at the terminals of the light sources.

IMPORTANT NOTE

The quality and output of a public lighting installation and the rapidity with which its performance deteriorates depends in large measure on the right choice of lantern, light source, auxiliary apparatus etc .., and on the more or less perfect way in which these elements complement one another.

Therefore, all the indications given in the present chapter were established with the hypothesis that all these elements have been judiciously chosen according to the needs and conditions of all kinds which characterize the installation, and also according to one another.

Almost all the deteriorating factors mentioned above can be totally or partially mitigated by periodic replacement of used elements and by the cleaning of dirty parts. On the contrary little can be done about factors c and g once the installation is complete.

1.1. Maintained installation output

This output is clearly equal to the initial output multiplied by the product of all the depreciation factors : that is to say, in the absence of any replacements or cleaning, the output of a public lighting installation tends rapidly towards zero. This is reflected in the capital interest which such operations present from the twin points of view of economy and safety.

Even in the case of systematic maintenance, the integrated mean practical values of illumination (and thus of luminance) of an installation appear to be 20 to 30 % lower than the initial calculated values. For this reason in many countries, the standard specifications or codes of practice recommend that the installation is designed, to give at least the levels of illuminance E and luminance L multiplied by:

$$\frac{1}{1 - 20\%} = 1.25$$

1.2. Influence of variations in the reflection characteristics of the carriageway.

The reflecting properties of the surface change slowly from the moment it is brought into service. This change is significant during the first six months after which it slows down.

In the present state of knowledge, and given on the one hand the large variety of surfaces and on the other the decisive influence of the volume and nature of the traffic (speed, proportion of heavy vehicles, etc ..), it is impossible to predetermine exactly what the change in the reflecting properties of the carriageway will be. An approximation will be given by comparison with an existing installation with similar characteristics.

1.3. Reduction in the flux of light sources

The luminous flux of most sources decreases regularly from the time they are brought into service.

Given the uncertainty of the data in this field, quantitative indications cannot be given. Information on depreciation of data for a particular source should be obtained from the manufacturer.

1.4 Accumulation of dirt on the light sources and lanterns and aging of the lanterns

The rapidity and severity of the accumulation of dirt on the light sources and the lanterns varies considerably according to the nature and construction of the lantern (open or closed, sealed or non sealed), the height of the sources, and above all the degree of humidity and pollution of the ambient atmosphere which itself depends upon a number of factors (volume and nature of traffic flow, climate, wind pattern, siting of the installation, etc..).

As an example figure 1 shows the factors for the reduction in the flux emitted by a lantern according to the different degrees of pollution of the atmosphere (*)

Curve I : corresponds to the following general conditions : appropriate soil (ballast, grass); moderate and not so rapid traffic; absence of heavy vehicles; rural areas and residential streets,

Curve II : as for curve I, with more important traffic flow; some heavy vehicles; major routes outside urban areas,

Taken from the American National Standard Practice for Roadway Lighting (1973 Edition).