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TECHNICAL REPORT

INTERNATIONAL RECOMMENDATIONS FOR MOTORWAY LIGHTING

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INTRODUCTION

PURPOSE OF RECOMMENDATIONS

The aim of the following recommendations is to lay down the fundamental principles which govern the lighting of motorways and to recommend certain well-established values and techniques. These principles and techniques are those at present held by the experts of Committee TC-4.6 of the Commission Internationale de l'Eclairage taking into consideration the comments which have been received from National Committees of countries affiliated to the C.I.E.

The technique of lighting varies in different countries; possibilities and usages vary. National Codes cannot in practice be identical since they have been designed to meet the needs of and to be used in the particular circumstances of the country. Nevertheless it is possible to state certain principles and techniques which are of general application.

These are described in accordance with recent research and experience, so that they may serve as a basis for National Committees desirous of issuing a code of their own, or of revising an out-of-date code.

The only methods of providing adequate lighting included are those which are established, and which give good results within acceptable economic limitations. They are not, however, mandatory, and every encouragement is given for research into new standards and methods.

These recommendations do not therefore constitute a code. It is hoped that they may serve as a basis for the drafting of National Codes, so that in the not too distant future they may lead to closer uniformity between National Codes, a uniformity which is demanded by the growing development of international traffic links.

INTRODUCTIONBUT DES RECOMMANDATIONS

Le but des recommandations ci-après est de poser les principes fondamentaux qui régissent l'éclairage des autoroutes, et de recommander certaines valeurs ainsi que certaines techniques bien établies. Ces principes et ces techniques sont ceux que préconisent actuellement les experts du Comité TC-4.6 de la C.I.E., compte tenu des commentaires reçus des Comités Nationaux des pays affiliés à la C.I.E.

La technique de l'éclairage, ainsi que les possibilités et les usages, varient suivant les pays. Les divers codes nationaux ne peuvent pratiquement pas être identiques, étant donné qu'ils ont été établis de manière à répondre aux besoins et aux circonstances propres à chaque pays. Il est néanmoins possible de dégager certains principes et techniques d'application générale.

Ceux-ci ont été définis en accord avec les derniers progrès techniques, en sorte qu'ils puissent servir de base aux Comités Nationaux désireux de publier leur propre code, ou d'actualiser un code périmé.

Parmi les méthodes susceptibles de donner un éclairage satisfaisant, seules ont été retenues celles qui sont bien établies, et qui donnent de bons résultats à des conditions économiques acceptables. Toutefois, l'emploi de ces méthodes n'est pas obligatoire, et la porte reste ouverte pour la recherche de nouvelles techniques et de nouvelles méthodes.

C'est pourquoi ces recommandations ne constituent pas en elles-mêmes un code, mais on espère qu'elles pourront servir de base à l'établissement de codes nationaux, en sorte que, dans un avenir point trop éloigné, elles entraînent un certain degré d'uniformité entre les codes nationaux, uniformité que le développement croissant du trafic internationale rend hautement souhaitable.

EINFÜHRUNGZWECK DER EMPFEHLUNGEN

Das Ziel der folgenden Empfehlungen ist es, die grundlegenden Prinzipien darzulegen, die für die Beleuchtung von Autobahnen massgebend sind, und gewisse gut begründete Werte und Techniken zu empfehlen. Diese Prinzipien und Techniken sind diejenigen, die von den Experten des Komitees TC-4.6 der Commission Internationale de l'Eclairage für richtig gehalten werden. Dabei wurden die Stellungnahmen berücksichtigt, die von den der CIE angehörenden Nationalen Komitees abgegeben wurden.

Zwischen den in den einzelnen Ländern üblichen Techniken und Möglichkeiten bestehen Unterschiede. Nationale Leitsätze können in der Praxis nicht übereinstimmen, da sie aufgestellt wurden, um die Erfordernisse des jeweiligen Landes zu erfüllen und unter den besonderen Umständen des Landes angewandt zu werden. Trotzdem ist es möglich, bestimmte Grundsätze und bewährte Techniken festzustellen, die allgemein gültig sind.

Diese Grundsätze und Techniken entsprechen dem letzten technischen Stand, so dass sie den Nationalen Komitees als Grundlage dienen können, die eigene Leitsätze herausgeben oder überholte Leitsätze überarbeiten wollen.

Nur bewährte Verfahren wurden berücksichtigt, die eine angemessene Beleuchtung ermöglichen und die gute Ergebnisse unter annehmbaren wirtschaftlichen Bedingungen liefern. Sie sind jedoch keineswegs verbindlich, und jede Gelegenheit sollte wahrgenommen werden, neue Richtlinien und Verfahren zu entwickeln.

Diese Empfehlungen stellen also keine Leitsätze dar, aber es ist zu hoffen, dass sie als Grundlage für den Entwurf nationaler Leitsätze dienen, so dass sie in nicht zu ferner Zukunft zu einer gewissen Einheitlichkeit in den nationalen Leitsätzen führen, zu einer Einheitlichkeit, die bei der zunehmenden internationalen Verkehrsverflechtung notwendig ist.

1 INTERNATIONALE DEFINITION DER AUTOBAHN

"Autobahnen sind Strassen allein für den Kraftfahrzeugverkehr; sie sind nur an besonders dafür bestimmten Anschlussstellen zugänglich und haben keine höhengleichen Kreuzungen.

Diese Strassen haben im allgemeinen zwei getrennte und unabhängige Richtungsfahrbahnen, wobei jede Richtungsfahrbahn mindestens zwei Verkehrsspuren mit einer Breite von minimal je 3,5 m hat." (1)

(1) Diese Regelbreite kann auf Stadtautobahnen verringert werden.

1 INTERNATIONAL DEFINITION OF MOTORWAYS

"Motorways are roads for automobile traffic only; they are accessible only from specially designed interchanges and have no crossings at grade.

These roads generally have two separate and independant one-way carriageways, each carriageway having at least two traffic lanes, each with a minimum width of 3,5 m". (1)

The recommendations given hereafter are applicable not only to motorways as indicated in the title, but also to all kinds of road restricted to automobile traffic, as defined in footnote (2).

2 GENERAL RECOMMENDATIONS

2.1 Importance of lighting the length of motorways

On the basis of the details which he sees in his field of vision and of the changes that occur in this due to his motion, the driver should obtain good optical guidance (3) and comfortable, reliable information on:

1. the part of the road he expects to traverse in the next five to fifteen seconds;
2. his own position and movement with respect to this part of the road;
3. the position and movement of other road users on or entering this part of the road;
4. the position of possible obstacles in this part of the road;
5. that this part of the road really is free and fit for driving over, when no obstacles have been observed by him.

- (1) This statutory width may be reduced on urban motorways.
- (2) French terms: Autoroutes et voies express.
American terms: Highways, Expressways, Turnpikes etc.
German terms: Autobahnen, Schnellstrassen und Hochleistungsstrassen.
- (3) In addition to fixed lighting, other measures will frequently be necessary to ensure this optical guidance, particularly when very high mountings are used (see 4.5.3).

Moreover, he also has to digest the visual signals which he receives from the various road signs, markings and traffic lights along the road, or from other road users (e.g. braking lights and direction indicators, apart from the normal vehicle signal lights such as side lights and rear lights).

Since driving speeds on motorways are high compared with speeds on normal roads, the requirements for the lighting system, as means of providing the necessary visual information, are extremely severe. Thus, car lights are not always satisfactory for these problems.

Accidents may be very serious because of high speeds. Well-designed and carefully maintained installations of fixed lighting can make an important contribution to the safety of night travel on motorways.

Lighting of motorways can be justified in terms of the number of vehicles per hour at night and the consequent saving of lives and material damage (4). It may also be justified in respect of drivers convenience and comfort, of better round-the-clock use of the motorway, and also where adverse weather conditions are frequent. The conclusion which might be drawn from what has been said is that traffic conditions may justify lighting of motorways from one end to the other.

2.2 Motorways in urban areas

Motorways in or in the vicinity of built-up areas should, in any case, be continuously lighted, including the access and exit roads in these areas.

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- (4) In some countries there is an attempt to demonstrate the economic justification of a motorway lighting installation by reduction of the accident rate per million vehicle kilometers. Such a justification appears to become valid beyond a certain threshold of traffic in terms of number of vehicles per hour at night.

Here are some references:

Road Research Laboratory Report LR 79: "Cost of Road Accidents in Great Britain", and other documents.

British Road Federation: Basic Road Statistics 1969.

International Road Federation: World Road Statistics 1967.

Public Roads (USA) October 1969: Fatal accidents on completed sections of the Interstate Highway System, 1968.

Traffic Engineering and Control (G.B.) January 1968: Influence of Lighting on Cost of Road Accidents (Granville Berry).

2.3 Motorways in rural areas

If financial considerations prevent, for the time being, the installation of lighting on the whole length of the motorway, the lighting of special points of the motorway network may still be necessary.

Not all such points are of the same importance and the order of importance is as follows:

- a. Complex interchanges, tunnels and toll booths situated across the motorway itself;
- b. Sections lying between two lighted zones, separated by not more than about 1500 m;
- c. Long sections of up-gradient;
- d. Sections crossing regions where fog is common;
- e. Parking areas, petrol stations, underpasses and toll booths situated by the side of the motorway.

N.B. If the motorways are not being lighted when constructed, provision should be made to enable lighting to be installed subsequently, with a minimum of disturbance to traffic or to the road and structures.

2.4 Motorway signs

Even on lighted motorways, it is important to provide traffic signs with individual lighting, the technique of which will be dealt with in a subsequent document.

3 QUALITY CRITERIA

The quality of motorway lighting installations is determined by the four following criteria:

- general level of luminance,
- degree of uniformity of luminance,
- glare limitation,
- optical guidance.

3.1 Level of luminance

As recommended by the INTERNATIONAL RECOMMENDATIONS FOR THE LIGHTING OF PUBLIC THOROUGHFARES (5), the mean level of luminance on motorways should be 2 cd/m^2 (minimum maintained value) when the carriageway is dry.

(5) C.I.E. Publication No. 12 (E-3.3.1) 1965.