

FOREWORD

The TRB Committee on Visibility is engaged in a continuing effort to disseminate information on critical visibility topics to individuals responsible for providing motorists with a safer highway environment. One means is through the conferences and symposia which the Committee sponsors. Seven of these have been held since 1968.

This Circular presents abstracts of papers given at the most recent Symposium, held in Washington, D.C., from July 30 to August 1, 1984. Entitled "Symposium on Providing Visibility and Visual Guidance to the Road User," the meeting was developed in cooperation with the Division on Lighting and Signaling for Transport of the International Commission on Illumination. It was designed to present up-to-date information from research and development currently underway, as well as recent research results in the area of night visibility. Topics covered in the sessions included road and vehicular lighting, delineation, signing and visual signaling.

This Circular also contains a listing of the over 100 attendees at the Symposium, including the program participants. Readers desiring more information on topics reported in the meeting have the opportunity, therefore, of contacting authors of presentations, using the address list provided.

SYMPOSIUM INTRODUCTION

Hans-Henrik Bjorset, University of Trondheim, Norway

As Director of the International Commission of Illumination (CIE), Division 4: Lighting and Signaling for Transport, I would like to thank the Transportation Research Board's Committee on Visibility and its chairman Mr. Stark, Illinois Department of Transportation, and the Symposium Planning Committee and its chairman Mr. Schwab, Federal Highway Administration, for arranging this Symposium to follow our Division 4 meetings here in Washington, D.C.

Throughout a long period of years we have tried to link our meetings to a symposium every second year. We are very happy that at long last we could come this year to the U.S.A., after the kind invitation from the U.S. National Committee of the CIE and the U.S. member of Division 4. May I here take the opportunity of saying how much the CIE visitors have enjoyed visiting the U.S.A. and to thank Dick Schwab, John Arens and their helpers for their great efforts and continuing care before and during our Technical Committee and Divisional meetings.

For those of you who do not know about the activity of CIE Division 4, I would like to give a brief survey. The terms of reference of Division 4 are: "To study lighting and visual signaling and information requirements of transport and traffic, such as road and vehicle lighting, delineation, signing and signaling for all types of public roads and all kinds of users and vehicles and visual aids for modes other than road transport."

A number of Technical Committees, established within the Division, work with enthusiasm and effectiveness toward realizing the working program of the Division. These Technical Committees are:

- Signals for Traffic Control
- Road Lighting as an Accident Counter-Measure
- Urban Lighting
- Road Markings
- Signs
- Vision Through Perturbed Atmosphere
- Design Methods for Road Lighting
- Tunnel Lighting
- Fundamentals of the Visual Task for Night Driving
- Automobile Lighting Systems
- High Level Matters

In addition, reporters are appointed on a number of items that may become the basis for new technical committees. These items are:

- Effective Intensity of Flashing Lights
- Road Surfaces and Lighting
- Effects of Complex Backgrounds on Conspicuity and Recognition
- Daytime Running Lights on Vehicles
- Lighting Guidance for Waterways and Off-Shore Platforms
- Interference of Light with Astronomical Observations
- Cycle and Moped Lights
- Railway Carriage Signal Lights

Our work is aiming at tomorrow and the distant future. Nevertheless, it could be of interest, and give perspective to our work, to look back on the past for a few minutes.

Traveling at night was not easy in olden times. In his most interesting book, "The Social History of Lighting," Mr. William T. O'Dea writes: "Traveling at night was not usual among ordinary folk -- a visit could be planned for the time of the full moon. More important folk might have attendants with torches -- Propertius (54 B.C. - A.D. 2) tells us that the Romans, who used wax torches, regarded the number of torch ends abandoned outside the house of a lady of more beauty than virtue as a matter for scandal." He also added, "Scandal has ever been the doom of beauty."

Mr. O'Dea is describing a most interesting development. While this is not the time or place to go into more details, it is worth noting that many places tried in vain for several hundred years to establish effective street lighting and make life more secure. From the end of the 17th and through the 18th Century, it seems that better conditions and solutions of street lighting were established. In 1729, Daniel Defoe published a pamphlet decrying the robbery with violence taking place in the poorly-lit streets. In 1736, the City of London installed 5,000 lamps in the streets. In two years this figure was trebled. "Oxford Street alone was reputed to have more lamps at this time than the whole of Paris."

Other towns had similar developments. Yet, as recently as 1816 in Cologne, it was surprisingly argued that "the provision of gas street lighting would frighten horses and be an aid to thieves and cut-throats." In the 17th century there was no such illusion. Street lighting was looked upon as the only answer to disorder, and there are records of excellent lighting from oil lamps in Amsterdam in 1669 and of lighting at Hamburg (1675), Vienna (1687) and many other towns in Europe about the same time.

Street lighting with gas was a great step forward. In 1823 (Mr. O'Dea tells us), London had almost

40,000 public gas lamps lighting 215 miles of London's streets. Electric lighting began with the arc lamp. In the U.S.A. the Brush Company had 25,000 lamps (out of a total of about 90,000) burning every night in 1884. The Journal of Society of Arts, London, in December 1884, recorded impressions of a journey from U.S.A. to Britain:

"I know of nothing more dismal than to be transplanted from the brilliantly illuminated avenues of New York to the dull and dark streets of London. This happened to me very recently. I drove from the Windsor Hotel, New York, to the Cunard Wharf, a distance of about 4 miles through streets entirely lighted by electricity. I drove from Euston to Waterloo (London) without seeing a single electric light."

Traffic signals also have an interesting history. In 1868 semaphore arm signals with gas lamps were installed in London and met with a good response from the public. Unfortunately they exploded and injured a policeman and this put back the development of traffic signals until the first manually operated three color signals were installed in New York in 1918. There followed systems in France, Germany, Britain and Italy, and in 1932 the first automatic traffic signals.

Let us now turn from Mr. O'Dea's "Social History of Lighting" to the present, the opening of this Symposium with the title "Providing Visibility and Visual Guidance to the Road User."

The groups of topics in the Symposium correspond to many of our technical committees and indeed the title of the Symposium could be a good alternative title for Division 4, except that the Division endeavors to cover the whole transport scene where it is possible to do so.

The panel discussion this morning on "Visual Performance Needs for Driving at Night" is particularly interesting because it is a very difficult topic with which we in CIE have struggled for many years from the road lighting angle. Now Dick Schwab has agreed to take a broader look at it by chairing our technical committee "Fundamentals of the visual task for night driving." I hope that this discussion will help everyone here understand more clearly the problems involved.

I think it is also significant and timely that there are six papers on the important subject of traffic signs. These papers cover a wide range of aspects that must be thoroughly researched if traffic signs are to be correctly designed and illuminated so as to perform equally well by night as by day.

I am also pleased to see that road lighting has its share of the program, because there are many aspects still to be researched, particularly the performance in wet conditions.

There is also an important paper on vehicle lighting, and the closing discussion on future research and implementation requirements could be of great importance for the future working program of Division 4.

I think it is a particularly good idea to include the tour to the Turner-Fairbank Highway Research Center in this Symposium. It will be most useful for researchers from other countries, indeed from

other continents, to see at first hand the organization and facilities for highway research in the U.S.A.

To conclude: I am convinced that this joint Symposium will be of considerable value and importance for the participating organizations and individuals.

REMARKS TO VISIBILITY SYMPOSIUM PARTICIPANTS

Thomas B. Deen, Executive Director, Transportation Research Board

Mr. Deen joined with Mr. Schwab and Dr. Bjorset in opening the Symposium and welcoming the participants. In addition to his remarks acknowledging the efforts of the TRB Committee on Visibility in organizing the Symposium, he commented briefly on TRB activities and current issues in the field of visibility.

TRB Activities Related to Visibility

In addition to the symposia and other activities planned by this committee, such as technical sessions during the TRB Annual Meeting, TRB can point to a long history of concern with visibility issues. In the National Cooperative Highway Research Program, for example, there have been more than a dozen research projects directed to illumination and visibility. These projects alone have totaled over \$2,000,000 in research funding, making them a significant proportion of the total research activity in NCHRP.

Two current projects relating to pavement markings and delineation questions are "Temporary Markings for Construction, Maintenance, and Utility Projects" and "Service Vehicle Lighting and Traffic Control Systems in Work Zones."

Issues in Nighttime Visual Guidance

Not all but most of the discussions at this Symposium are focused on the problem of nighttime visibility. The emphasis seems appropriate. We have over the years developed good lighting standards for highways, particularly for freeways and urban arterial streets. These standards are fairly well accepted, and followed by organizations like AASHTO, for example. Many urban areas are well illuminated, using the latest technology, as the aerial view in a nighttime arrival at any major airport usually demonstrates. But there are still many rural, suburban, and even urban locations with poor lighting or none at all, with inadequate signing and with poor roadside delineation. And when energy costs have gone up, many areas have experienced lighting levels that went down or even out. So the need for lighting and good nighttime visibility is not something that is necessarily recognized and accepted.

Those deficiencies that do exist are being addressed, at least to some extent. The recent initiation of 100 percent Federal funding eligibility for highway safety delineation and marking shows recognition of night driving problems. In announcing this funding eligibility recently, FHWA Executive Director Richard D. Morgan noted that in the U.S.A. during 1981, 57 percent of highway fatalities occurred at night. Thirty-eight percent of all fatalities occurred on unlighted streets and highways. Overall, the nighttime