The Development of Optimal On-Premise Electronic Message Center (EMC) Lighting Levels and Sign Lighting Measurement Techniques

Prepared by

The Pennsylvania State University

The Pennsylvania State University ❖ University of Maryland
University of Virginia ❖ Virginia Polytechnic Institute and State University ❖ West Virginia University

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16. Abstract

Research conducted recently for the United States Sign Council Foundation found no consensus in the research literature or the practices of the commercial electronic message center (EMC) industry on lighting measurement or appropriate lighting levels of on-premise EMCs, nor are there any national standards for EMC lighting levels developed through research at this time. It was clear that, in order to make them optimally legible during daytime hours and at night, the lighting levels of these EMCs must be (and typically are) adjusted automatically as a function of ambient light level. However, the procedures for measuring EMC light levels and the appropriate levels to set the signs during some daytime scenarios (e.g., dusk/dawn and overcast) and at night are inconsistent among the leading U.S. EMC manufacturers and are not supported by empirical, independent, human factors data. This has led to complaints of EMC's being "over bright," primarily at night, though this issue has also been reported during dusk and dawn hours and under overcast daytime conditions. The objective of this research was to begin addressing this situation by developing, through original field and test track research, EMC lighting levels that would optimize sign legibility at night from the prospective of a motorist who is viewing the EMC, and to develop standard light level testing procedures.

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Background and Objectives

Earlier research conducted recently for the United States Sign Council Foundation (USSCF) found that there is no consensus in either the research literature or the practices of the commercial electronic message center (EMC) industry on lighting measurement or appropriate lighting levels of on-premise EMCs (Garvey, 2010), nor are there any national standards for EMC lighting levels developed through research at this time. It was clear from that research that, in order to make them optimally legible during daytime hours and at night, the lighting levels of these EMCs must be (and typically are) adjusted automatically as a function of ambient light level. However, the procedures for measuring EMC light levels and the appropriate levels to set the signs during some daytime scenarios (e.g., dusk/dawn and overcast) and at night are inconsistent among the leading U.S. EMC manufacturers and are not supported by empirical, independent, human factors data. This has led to complaints of EMC's being "over bright," primarily at night, though this issue has also been reported during dusk and dawn hours and under overcast daytime conditions. The objective of this research was to begin addressing this situation by developing, through original field and test track research, EMC lighting levels that would optimize sign legibility at night from the prospective of a motorist who is viewing the EMC, and to develop standard light level testing procedures.

The research plan consisted of three tasks. Tasks 1 and 2 were to use The Larson Institute's test track to develop appropriate standard EMC sign lighting testing methods, and to conduct preliminary original human factors research with the goal of optimizing EMC lighting level based on sign legibility. Task 3 was the development of a Final Report that included standards for EMC light levels and light level measurement based on the results of Tasks 1 and 2.

Task 1: Development of a Standard On-premise EMC Light Level Measurement

Overview The objective of this task was to test the various EMC light level measurement methods and procedures identified by the recent USSCF study mentioned above (Garvey, 2010). The National Electrical Manufacturers Association (NEMA), Rensselaer Polytechnic Institute, and Lighting Sciences, Inc., among others, have proposed standardized methods and procedures to measure EMC lighting. The objective of Task 1 was to evaluate these practices using signs mounted at the Larson Institute test track to determine which method (or combination of methods, or new method) proved to be the most consistent, accurate, and easy to follow.

Results The USSCF was unable to obtain any signs from the manufacturer for use in testing during the period of performance for this project. Therefore, there are no results to report for Task 1.

Task 2: Human Factors Study

Overview As ambient lighting decreases from bright daylight to dark nighttime, the human eye needs less light to optimally perform normal tasks like reading an illuminated sign. Sign lighting, which in the daytime might be adequate or even too dim, can become performance-reducingly bright at night. While other recommended maximum EMC levels and dimming strategies use the point at which the sign creates glare or light trespass as the limiting metric for maximum lighting levels, the objective of this study was to use EMC *legibility* as the dependent variable for optimizing EMC luminance at night.

Results Members of the research team received training during the project in interacting with human subjects in social science research and were certified in compliance with Penn State's Institutional Review Board. Informed consent forms were developed and approved by the IRB, as well as data collection sheets and subject recruitment advertisement copy. However, as the USSCF was unable to obtain any signs from the manufacturer for use in testing during the project period of performance, there are no results to report for Task 2.

Task 3: Final Report and On-Premise EMC Brightness and Light Measurement Standards

The ultimate goal of this research was an on-premise EMC brightness standard, based on solid science and engineering, that would ultimately be incorporated into every EMC manufactured by reputable U.S.-based manufacturers, and written into local U.S. sign codes, and a sign lighting measurement standard for on-premise EMC brightness. However, because the USSCF was unable to obtain samples of signs from the manufacturer for the researchers to test, although efforts were made over the full course of the 6-month study, it was not possible to accomplish this goal within this time frame.

Plan for Completion of the Research

In the end, the USSCF finally obtained signs, and those signs are being used in the conduct of a related USSCF contract with Penn State, which began January 1, 2013. As there is a great deal of overlap between that contract's goals and the goals of this research project, the researchers intend to address the testing of signs from this work during the time frame of the new contract. When those data have been gathered and analyzed, this report will be updated with the results of the research.

References

Garvey, P.M. (2011). *On-premise Electronic Message Center (EMC) Nighttime Dimming Research Review and State of the Practice Industry Survey*. Final Report for the United States Sign Council. 28 pp.