

Comprehensive Review of Literature on Signage: 1950 to Present

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1. 2000 Legal Forum Book, Volume VIII, IX, X, XIXII. Outdoor Advertising Association for America.
 - i. Compiled from the OAAA's 1998 Legal Forum, these publications include the complete text of court cases dealing with billboards. The issues covered include: First Amendment, takings, valuation of eminent domain, ordinances, anti-trust, taxation, pleadings, cap and replacement resolutions, Fifth Amendment and content control.
2. A Signs Systems Manual. 1970. New York: Praeger Publishers.
 - i. This book includes a basic system for designing, constructing and displaying signs, together with examples of schemes which have been produced by leading international designers.
3. Analysis of Changes, 2005 NEC and DVD. 2005. International Association of Electrical Inspectors.
 - i. Abstract:
 - ii. With this ebook, get a jumpstart on 400 of the most crucial changes that impact your work! Analysis of Changes, 2005 NEC, a unique reference from IAEI and NFPA, the two major authorities on code interpretation, helps you plan, execute and evaluate jobs with clear explanations about revised rules in the National Electrical Code®. The book has been compiled into a .pdf document that makes reading about the changes even easier with a portable format.
4. Analysis of Changes, 2008 NEC and DVD. 2008. International Association of Electrical Inspectors.
 - i. This publication includes new articles that explore critical operations power systems, reinforced thermosetting resin conduit, control systems for permanent amusement attractions, and electrified truck parking space equipment.
5. Anderson, W. 1998. Where Have You Gone, Starlight Café? 1998. Maine: Anderson & Sons Pub Co.
 - i. This publication serves as source for classic and interior design featuring postcard illustrations, odd-shaped buildings, and freestanding diners from the 1930's through the 1960's.

6. Ang, S. H. & Leong, S. M. 1996. *The mediating influence of pleasure and arousal on layout and signage effects*. Singapore: Department of Marketing, Faculty of Business Administration.
 - i. This study investigated the effects on consumer emotional responses and behavior of two physical environment factors: layout and signage, in addition to the overall streetscape in two retail settings. The results attested to the importance of pleasing layouts in signage as the more favorable ones resulted in positive emotional responses, more specifically in terms of pleasure. This research calls attention to the significance of design and how the consumer response to signage layouts may affect business.
7. Baeder, J. 1996. *Sign Language: Street Signs as Folk Art*. New York: H. N. Abrams.
 - i. This publication considers the use of street signs as art in public spaces. It considers the beauty in letterforms, buildings as signs, vehicles as signs, as well as figurative signage.
8. Baines, P. and Dixon, C. 2003. *Signs Lettering in the Environment*, Harper Collins.
 - i. This work explores signage from both a design and functional perspective. It focuses on letterforms and typography found in public places that help navigate towns, cities, and country sides. The authors also highlight signage's contribution to the sense of place of an environment. The book includes 700 color images of examples from around the world as it discusses the function and execution of signage as the subject involves graphic designers, lettering artists, architects, and planners.
9. Baker, J. 1986. *The Role of the Environment in Marketing Services: The Consumer Perspective*. In Czepiel, J.A., Congram, C.A. and Shanahan, J. (Eds), *The Services Challenge: Integrating for Competitive Advantage*. Chicago: American Marketing Association. 79-87.
 - i. This work includes several studies that investigate the relationship between environmental cues, such as ambient congruence with product offering, fair spatial layout and signs, and their effect on customer affective expectation, perceived control, cognitive pleasure and patronage intention. The research uses multi-group structural equation modeling of survey data, finding significant differences on two links: the influence of signs on perceived control and of cognitive pleasure on patronage intention. The findings include that signs of the physical environment are positively and highly associated with customer perceived control. The results of these studies also suggest that cognitive pleasure induced from the physical environment is also positively and highly associated with patronage intention than online environment.

10. Ballinger, L.B. 1972. *Sign, Symbol, & Form*. New York: Van Nostrand Reinhold.
 - i. This book includes a compilation of the variety of signs and symbols commonly and not so commonly seen throughout Europe and North America. The author stresses the importance of well designed and planned signs as they are used to communicate. He stresses the goal of simplicity and directness for sign makers and designers in the making of sign as well as seeing signage as a work of art on the physical environment.
11. Barnard, M. 1998. *Art, Design, and Visual Culture: an Introduction*. New York: St. Martin's Press.
 - i. This book examines the visual experience offering an explanation and assessment of the traditional means of analyzing visual culture. The author draws on historical and contemporary examples, considering the role of artists and designers, the audiences and markets they sell to, and the different social classes that are produced and reproduced by art and design. This knowledge of design may prove valuable to signage aimed to promote a business by positive visual stimulation.
12. Bartram, A. 1975. *Lettering in Architecture*. London: Lund Humphries.
 - i. The focus of this publication is lettering in public spaces. Its illustrations are arranged chronologically, surveying architectural lettering in Britain and Italy. The author conveys strong historical weighting and argues for distinctive English tradition.
13. Battelle. D. 2004. Amber, emergency, and travel time messaging guidance for transportation agencies. Battelle Memorial Institute, Final Report.
 - i. Abstract:
 - ii. This study was undertaken to provide guidance to transportation officials in planning, designing, and providing various types of traveler information messages using changeable message signs (CMSs). Three primary issues related to messaging are addressed by these guidelines: (1) The basis for the message, i.e., what condition is occurring, what segment is impacted, and what outcome or driver response is desired; (2) How the content is determined, i.e., how is the message structured to maximize driver comprehension, is the message aimed at commuters, unfamiliar drivers, or other groups, is the content automated or put together by a TMC operator, and how is the message coordinated with other information dissemination techniques, e.g., 511; and (3) What policies govern the display of messages, i.e., whose authority is needed to initiate a message, what are the arrangements for posting, updating, and terminating a message, what is the process for interagency coordination (especially with non-transportation agencies), how are messages

prioritized during periods when multiple messages are desired, and how are 24/7 operations ensured. The study was divided into three tasks: (1) a literature/background review; (2) a "scan" of the practice; and (3) best practices/lessons learned.

14. Beijer, D. 2004. Observed driver glance behavior at roadside advertising. Presented at Transportation Research Board Annual Meeting, Washington, D.C.

- i. Abstract:
- ii. Express routes in North America are becoming more crowded, both in traffic density and in visual clutter, resulting in a higher demand for driver attention, a possible concern for regulators. Advertising signs add to this demand on visual attention. This study focused on glance behavior of 25 drivers at various advertising signs along a Toronto expressway. Subjects averaged glances of 0.57 seconds in duration (sd = 0.41), and 35.6 glances per subject in total (sd = 26.4). Active signs, containing moveable displays or components, comprised 51% of signs, and received significantly more glances (69% of all glances and 78% of long glances). Number of glances was significantly lower for passive signs (0.64 glances per subject per sign) when compared to active signs (greater than 1.31 glances per subject per sign). Number of long glances was also greater for active signs compared to the passive signs. Sign placement in the visual field may be critical. This study provides empirical information to assist regulatory agencies in setting policy on commercial signing.

15. Bergeron, J. 1997. An evaluation of the influence of roadside advertising on road safety in the greater Montréal region. Proceedings of the 1997 Conference of the Northeast Association of State Transportation Officials Quebec, Canada.

- i. Abstract:
- ii. In Quebec, the Loi sur la publicité le long des routes [Act governing roadside advertising] adopted in 1988 prohibits the installation of billboards within 100 meters of a highway right-of-way. However, the Act does not apply to Urban Community, City and Township territories. This legal loophole has allowed many billboards to be constructed alongside highways in metropolitan areas including Montreal. It has been shown that such billboards are accident-promoting factors. A-3 In an urban setting, analysis of the relation between posted advertising - either conventional or variable message type - and increased driver information-processing mental loading defines this problem clearly. In light of its responsibilities in road safety matters, the ministère des transports has therefore proposed amending the

Code de la securite routiere to prohibit the installation of such billboards in certain areas deemed particularly at risk.

16. Biegeleisen, J. I. 1989. *Book of 100 Type Face Alphabets*. ST Publications.
 - i. This publication provides the upper and lower case versions of 100 type face alphabets including full-page descriptions of their essential characteristics, practical construction tips, and recommendations for application.
17. *The Big Picture*. 2002. ST Media Group International Inc.
 - i. Description:
 - ii. This book features the complete range of digitally printed graphics, from skyscraper building wraps to vehicle graphics, retail uses and more. Nearly 100 projects represented in almost 300 color photos demonstrate the growing number uses for digitally printed graphics, from advertising and display to exhibit, museum and environmental graphics. Also included are sections on digital fine art, textile and specialty applications. This book from the publishers of *The Big Picture*, the leading magazine in the industry, is a terrific resource of what is new and what is possible with digitally printed graphics.
18. Bitner, M. J. 1992. Servicescapes: The Impact of Physical Surroundings on Customers and Employees. *Journal of Marketing* 56(2): 57-71.
 - i. This paper explores the impact of physical surroundings on the behaviors of both consumers and employees using a conceptual framework. It utilizes literature from diverse disciplines to provide theoretical grounding for the investigation of how physical surroundings facilitate organizational and marketing goals. The results include key managerial and research implications.
19. Brill, L.M. (2002). LED Billboards: Outdoor advertising in the video age. SignIndustry.com. Available at <<http://www.signindustry.com/led/articles/2002-07-30-LBledBillboards.php3>>.
 - i. Abstract:
 - ii. LED video display billboards have emerged on a grand scale that converges into a unique display format that is one part print, one part television advertising and one 'digital hieroglyphics.' LED video billboards, like their print counterparts, can be seen hanging out on the sides of freeways silently shouting brand identity, product placements and message of 'buy now for the best deal of a lifetime.'
20. Browne, C. 1980. *The Mechanics of Sign Control*. Chicago: American Planning Association.
 - i. This report reviews sign regulations for both on-premise and off-premise signs. It includes a list of ordinance components and examines enforcement issues of signage.

21. Bus Signage for Persons with Visual Impairments. U.S. Federal Transit Administration. Transportation Research Board. Posted on September 20, 2004.
 - i. Description:
 - ii. The U.S. Federal Transit Administration has produced a website based on a best practices paper that addresses the Americans with Disabilities Act specifications for destination signs using light-emitting diode (LED) displays.
22. Calori, C. 2007. Signage and Wayfinding Design. Wiley Publishing.
 - i. Description:
 - ii. In this practical guide, author Chris Calori outlines her "Signage Pyramid" method. This approach divides signage into three interrelated focus areas and components - the Information Content System, the Graphic System, and the Hardware System - making it easier to solve the often complex design problems posed in a comprehensive signage program.
23. Campbell, J.L., Carney, C. & Kantowitz, B.H. 1998. Human Factors Design Guidelines for Advanced Traveler Information Systems (ATIS) and Commercial Vehicle Operations (CVO). Report No. FHWA-RD-98-057. U.S. Department of Transportation Federal Highway Administration.
 - i. Abstract:
 - ii. Significant advances in electronics and microcomputing during the past few decades have led to the feasibility of a functionally powerful, computer-based ATIS as part of the automotive environment. Although these systems range in functionality, they all have the goal of acquiring, analyzing, communicating, and presenting information to assist travelers in moving from a starting location to a desired destination. While systems under development or in production promise to improve travel safety, efficiency, and comfort, they represent a new frontier in ground transportation. This handbook is intended to address a growing information gap between the advanced and diverse status of automotive technologies such as ATIS devices, and the availability of human factors design criteria that can be used during the system design process. Specifically, while ATIS and CVO systems offer great potential benefits, their effectiveness depends on driver acceptance of the new technology, the ability of the systems to integrate the information with other driving tasks, and the extent to which the systems conform to driver physical and cognitive limitations and capabilities. The handbook summarizes human engineering data, guidelines, and principles for use by creative designers, engineers and human factors practitioners during the ATIS design process.

24. Cao, Y. and Wang, J.H. (2003). Evaluation of design and display factors of changeable message signs. Institute of Transportation Engineers 2003 Annual Meeting and Exhibit.
- i. Abstract:
 - ii. A two-phase study on the design and display factors of changeable message signs (CMSs) was conducted through a series of blocked-factorial experiments. Subjects sit in the driver's seat of a 1998 Ford Taurus sedan. Computers generated CMS images, merged with a driver's view driving video, and were projected onto a screen in front of the vehicle. Subjects were required to make proper responses signaling their comprehension of the CMS stimuli. Eighteen subjects balanced by age and gender participated the experiments. Phase I investigated the effects of discrete displayed CMSs' font size, font color, subjects' age, gender, and their interactions. It found that font color, drivers' age, and gender significantly affected response time. Green and 5 x 7 matrix were the best font color and font size, respectively. Older drivers responded the fastest among the three age groups but with the lowest accuracy. No significant correlations were found between response time and accuracy. Response times of different subjects were significantly different, but the effects of font color and size were consistent. Phase II studied the influences of display format, number of message lines, lighting, driving lane, and their interactions. It found that discrete displayed messages took less response time than sequential displayed ones.
25. Carter, D.E. 1998. American Corporate Identity 2000.HBI.
- i. This publication displays the work of over 400 American design firms featuring 1,500 projects in seven categories: complete identity programs, logos, package design, letterheads, corporate identity manuals, environmental graphics and corporate brochures.
26. Castro, C. & Horberry, T. 2004. *The Human Factors of Transport Signs*. Boca Raton: CRC Press.
- i. This work investigates key transport sign research and explores new technologies that are revolutionizing signaling such as Variable Message Signs and Intelligent Transport Systems. The authors concentrate on the road environment and general signing issues as well as addressing specific railway and other transport modality topics. The international contributors of the book study driver psychology and interaction with transport signs as well as the strength and weaknesses of different types of signs.

27. Chatterjee, K., Hounsell, N.B., Firmin, P.E., and Bonsall, P.W. 2002. Driver response to variable message sign information in London. *Transportation Research. Part C: Emerging Technologies* 10(2): 149-169.
- i. Abstract:
 - ii. This paper presents the results of a study of driver response to information on variable message A-4 signs (VMS) that have been installed in London to notify motorists of planned events and current network problems. Questionnaires were employed to investigate the effect of different messages on route choice. Stated intention data from the questionnaire was used to calibrate logistic regression models relating the probability of route diversion to driver, journey and message characteristics. The resultant models indicate that the location of the incident and the message content are important factors influencing the probability of diversion. A survey of drivers' actual responses during the activation of an immediate warning message showed that only one-third of drivers saw the information presented to them and few of these drivers diverted, although many found the information useful. The rate of diversion was only one-fifth of the number predicted from the results of the stated intention questionnaire. The low response rate achieved for the stated intention survey is thought to have exaggerated drivers' responsiveness to VMS messages. Survey data for another UK city with a newly installed VMS system showed that the number of drivers diverting due to VMS information was very similar to that expected from the results of the stated intention questionnaire. The results of the current study suggest that the low proportion of drivers noticing VMS information has implications for the future placement of VMS so that the best opportunities for drivers to see the information are exploited. Results also suggest that the current usage to display advance warnings may be detracting from its effectiveness as a means of disseminating immediate warning information in incident-management situations.
28. Chmielewska, E. (2005). *Logos* or the resonance of branding: A close reading of the *iconosphere* of Warsaw. *Space and Culture* 8(4), pp. 349-380.
- i. Abstract:
 - ii. This article inquires into the specificity of the local impact of global visual language. It focuses on the contemporary visual landscape of Warsaw and discusses the consequences of the palpable presence of the English language on the surface of the city. Through a close reading of brand names in their contexts, two questions are probed: How does the historical and symbolic meaning of place change through the

presence and form of these logos? What is the effect of their linguistically foreign idiom on the local language?

29. Churchill, D. L. 1996. Fiber optic light bar for edge lighted signage. Patent number: 5572818. U.S. Classification 40547; 362/26; 362/32.
 - i. Abstract:
 - ii. A fiber optic display sign for preselected sequential lighting of one or more of a plurality of transparent side-by-side panels each having viewable indicia thereon. Selective illumination of each of the panels is by a single light source which transmits light through a selective light transmitting device into fiber optic bundles which terminate at their opposite ends at, and are secured in, one or more openings defining a plurality of rows in an elongated light bar. The panels, when secured to the light bar having one edge of each panel in optical alignment with one of the rows of optical fiber bundle ends, may be sequentially illuminated to create distinctive visual effects as in advertising, multi-colored logo display or the like.
30. Claus, K.E. & Claus, R.J. 1976. *Signage: Planning Environmental Visual Communication*. Palo Alto: Institute of Signage Research. (Funded by HUD to investigate functions of signs)
 - i. This publication investigates the functions of signs in the environment; addresses the many stakeholders in efficient signage including businesses, planners, and designers; attempts to determine the effectiveness of signs; and describes how signage can act as a land use planning tool.
31. Claus, R. J. & Claus, K. E. *A review of the Street Graphics Concept - Some Issues to Consider*. Oak Brook: National Electric Sign Association.
 - i. This publication is a response to the book and film Street Graphics published by the American Society of Landscape Architects Foundation. The concept covered in this book and film, the authors believe, discriminates against various segments of the sign industry due to a misunderstanding of the range communication functions performed by signs. The authors review how this concept creates a possible extreme hardship on many small businesses who cannot financially afford other media.
32. Claus, R. J. & Claus, K. E. 1978. *The Sign User's Guide: A Marketing Aid*. Cincinnati: The Institute of Signage Research.
 - i. This guide covers the topics of the functions of signs and sign design. The authors also describe how business needs signage and include an industry case study in their investigation.
33. Claus, R. J. & Claus, K. E. 1977. *Small Marketers Aids 161 - Signs and Your Business*. City: U.S. Government Printing Office.

- i. This publication reviews the major contributions signage offers to businesses including providing information and direction for a business, providing a format for street advertising, and building a business's image.
- 34. Claus, R.J. & Claus S.L. *Unmasking the Myths About Signs: Learning to Use Signage as a Planning Tool for Intelligent Community Development*.
 - i. Description:
 - ii. This book examines seven prevalent myths about signage proclaimed as fact by the planning educational community. Through the use of facts and legal precedent, these myths are carefully dismantled revealing the economic value signs have in a consumer-based economy.
- 35. Claus, K.E. & Claus, R.J. 1971. *Visual Environment*. Ontario: Collier-Macmillan Canada, LTD.
 - i. This publication reviews the visual environment from several approaches. The authors investigate visual perception, the facts of visual communication, the institutionalization of visual communication including the sign industry, the nature and functions of signs, the role of bylaws in the creation of the visual environment, and comments on the efficient use of the visual environment.
- 36. Claus, R.J., Claus S.L., Claus, T.A. *The Value of Signs: A Guide for Property Appraisers, Brokers, Legal Professionals, Sign Users and Municipal Planners*. U.S. Small Business Administration.
 - i. Abstract:
 - ii. This book is a first attempt to provide extensive background information about signage in the context of valuation issues and techniques. It also explores the legal decision on government sign regulations, and explains how overly restrict regulations unwittingly restrict the economic potential of commercial signage to all community stakeholders. Finally, it guides the reader through principals of appraisal for both on-premise and outdoor signage.
- 37. Claus, R. J. & Staff. 1978-79. *Signage Quarterly*. Vol 1-2. Palo Alto: Institute of Signage Research.
 - i. This collection of publications is a series of manuscripts specifically tailored for the on-premise or business sign community. The range of topics of these papers involves all the phases of the sign industry- from marketing, design, production, installation and maintenance to the buyer or advertiser.
- 38. Claus, R.J., Claus, S. L., Claus, C.C., Claus, L.L. & Claus, T.A. 1992. *Comments on Report of Mayor's Task Force on Signage - Akron, Ohio*. Cleveland: Claus Consulting and Appraising.
 - i. This report presents an analysis of the report by The Mayor's Task Force on Signage (MTFS) for the city of Akron, Ohio dated March 1992. The authors' objective is to show how the restrictive sign code proposed by the MTFS will limit Akron's

economic growth by restraining trade and unnecessarily restricting free speech. This publication also includes a background of signage and explains the policies behind the suggested restrictive sign code, as well as responding to the reliability and validity of the MTF's research. The authors also provide suggestions on how Akron could develop a more productive sign code in terms of legitimate land use and transportation municipal goals.

39. Claus, R.J., Claus, S. L., Claus, C.C., Claus, L.L. & Claus, T.A. 1992. *On Premise Sign Code Analysis - Euclid, Ohio*. Sherwood: Claus Consulting and Appraising.
 - i. This document includes an analysis of the City of Euclid's sign code for informational purposes only. The analysis includes a discussion of some criteria common to functioning sign codes in addition to several commercial communication industry cites to aid as references in the review of the current Euclid sign code.
40. Claus, R.J., Claus, S. L., Claus, C.C., Claus, L.L. & Claus, T.A. 1991. *Proposed Sign Code Considerations - Spokane, WA*. Sherwood: Claus Consulting and Appraising.
 - i. This document includes proposed measures for a sign code to be adopted by the city of Spokane. The authors believe that a sign code that enhances the growth and quality of life occurring in the City of Spokane will be another progressive step in successful land use planning.
41. Claus, R. J., Oliphant, R.M & Claus, K. E. 1972. *Signs: Legal Rights and Aesthetic Considerations*. Cincinnati: Signs of the Times Publishing Co.
 - i. This publication investigates signage as it involves a legal process as well as an aesthetic approach. It covers topics such as the urban landscape, the landscape formation as a decision-making act, the actors in landscape, the rationales involved including the conflicts of interests, the legal aspects of sign legislation, and the levels of participation in the legislative process.
42. Claus, R.J. & Yarger, N. 1991. *Variance Request For Pier 1 Imports - Germantown, TN*. Sherwood: Claus Consulting and Appraising.
 - i. This document is a request for a variance in a commercial zone to allow the addition of an on-premise business sign on the west side of Pier 1 Imports' Germantown, Tennessee store. Pier 1 Imports exists as an anchor tenant of Germantown Village Square Mall shopping center. The address of the subject property is 7730 Poplar Avenue, Suite #7, Germantown, Tennessee.

43. Center for Design Planning (U.S.) 1976. Streetscape Equipment Sourcebook. Chicago: American Public Works Association.
- i. This book contains information on the subjects of lighting, traffic control, paving, housekeeping and amenity, signage, safety and security.
44. Coetzee, J.L. (2003). The evaluation of content on outdoor advertisements. South African National Roads Agency Final Report. Available at <<http://www.itse.co.za/>>.
- i. Abstract:
 - ii. Using the number of bits on advertisement content as the only quantitative criteria was identified as a problem. Accident statistics were evaluated to determine the relationship between advertisements and increased accident rates and it was found that in general, advertisements result in higher accident rates. No accident data related to the content of advertisements was however found. This study investigates an analytical approach to evaluate the contents on advertisements, based on the characteristics of the driver. These characteristics include vision, reaction time, reading time, legibility factors, spare capacity to process information and selective attention. A parallel is drawn between a drivers reading of road signs and the reading of outdoor advertisements. A concept of the critical zone – the 500m in front of an advertisement - is developed and the control of content in this zone is quantified. Rules are proposed to evaluate the content for advertisements that will hopefully provide a more practical, defensible approach to evaluate the content of outdoor advertisements.
45. Collins, B.L. 1982. *The Development and Evaluation of Effective Symbol Signs*. Washington, D.C.: U.S. Dept. of Commerce, National Bureau of Standards.
- i. Out of Print
46. Colomb, M. and Hubert, R. 1991. Legibility and contrast requirements of variable-message signs. Transportation Research Record 1318: 137-141.
- i. Abstract:
 - ii. New technologies such as optic fibers and light-emitting diodes are now used for information matrix signs. A field study was carried out to evaluate the best conditions for the legibility of these signs during the day and at night. For legibility criteria, the contrast between the letters and the sign background is chosen for daylight conditions and the luminance of the letters for night conditions. The performance of some commercially available signs is compared with the study results.

47. Cox, B.S., Cox, A.B., & Cox, D.J. 2000. Motivating signage prompts safety belt use among drivers exiting senior communities. *Journal of Applied Behavioral Analysis* 33(4): 635–638.
- i. This study used an AB design, replicated five times, to evaluate the short- and long-term effects of a sign with the message "BUCKLE UP, STAY SAFE" attached to a stop sign at the exits of five different senior communities. Safety belt use was stable during two pretreatment assessments averaged across the five sites and 250 drivers (72% and 68% usage), but significantly increased following installation of these signs (94% usage). Six months after installation of the signs, the effect persisted (88% usage). These results show that such signage are important for the health of senior citizens and may be a cost-effective way of promoting safety belt use.
48. CTC & Associates, LLC (2003). Electronic billboards and highway safety. Bureau of Highway Operations, Wisconsin Department of Transportation. Available at <http://www.dot.wisconsin.gov/library/research/docs/tsrs/tsrelectronicbillboards.pdf>.
- i. Abstract:
 - ii. We located two FHWA resources that are especially helpful for getting familiar with the issues: the Office of Real Estate Services (ORES) Web site and the study entitled *Research Review of Potential Safety Effects of Electronic Billboards on Driver Attention and Distraction*. The study affords an in-depth look at how states are regulating electronic outdoor advertising, from lenient control at one end to the prohibition of outdoor advertising at the other. Wisconsin addresses the issue with rules for the content, timing and brightness of EBBs and tri-vision signs. However, standard billboard guidelines governing EBBs and tri-vision signs do not exist: few states, in fact, define the term “electronic billboard.” Research on the issue of electronic ads causing driver distraction would suggest that the jury is still out. While some studies conclude that extravehicular distractions cause crashes, it has proven difficult to identify and measure the role of electronic advertising in driver distraction. However, promising methodologies have been proposed for focused study of the issue, and for trimming the risk of driver distraction from electronic advertising.
49. Dadic, I., Kos, G., and Brlek, P. 2003. Application of changeable message signs in traffic. *Promet Traffic-Traffico*, 15(5): 307-314.
- i. Abstract:
 - ii. In the Republic of Croatia, changeable message signs are being introduced on high serviceable roads in order to improve the flow management in the network and increase the traffic safety level. The equipment installed in the past was not set

according to the unique criteria, thus resulting in the installation of relatively incompatible equipment set in a disorganized manner. This work presents the basic guidelines in applying changeable message signs, primarily on the Croatian motorways. The types and levels of influence on the traffic are described, and the traffic and weather criteria for the application of changeable message signs are defined. The paper also analyzes the principles of installing the changeable message signs on roads and road facilities, recommending priorities in presenting the changeable signs.

50. Davidson, L. 1999. *Vintage Neon*. Schiffer Publishing.
 - i. This book includes a tour of neon in working installations, signage, collections and museums, featuring over 350 photos from exploding bowling pins to lassoing cowboys.
51. Davis, P., Sunkari, S., Dudek, C., and Balke, K. 2002. Requirements specification for DMS message optimization software tool (MOST) Texas Department of Transportation Final Report No. FHWA/TX-03/4023-2.
 - i. Abstract:
 - ii. Composing a message for a dynamic message sign (DMS) requires managers and supervisors at the Texas Department of Transportation (TxDOT) Traffic Management Centers to consider numerous factors. For example, they must consider the content and length of the message as well as memory load for motorists. Following documented guidelines about formatting and phrasing of messages, the requirements for a software system called the DMS Message Optimization Software Tool, or MOST, are discussed. The system is designed to accept input data through a graphical user interface, to allow selection of terms, and to produce a message suitable for display in a DMS. The application automatically applies principles of good message design and allows users to customize their messages. The design of the system follows work done previously in TxDOT Project 0-4023.
52. *Designing Roadways to Safely Accommodate the Increasingly Mobile Older Driver*. The Road Information Program. Transportation Research Board. Posted on July 24, 2003.
 - i. Description:
 - ii. A study by The Road Information Program recommends a set of signage and lighting, intersection, and street and highway safety improvements designed to enhance the safety of older drivers.
53. Dewsnap, D. 1993. *Sign Design: Easy Type Guide*. Rockport: Rockport Publishers.

- i. This publication concentrates on the appearance of words on signs and offers guidance on how to make the most effective signage design. This book covers the principles of sign design and display faces, as well as providing a sign gallery.
- 54. Dixon, J. M. 2003. *Urban Spaces*. Urban Land Institute. Visual Reference Publications.
 - i. This publication includes an illustrated tour of 110 projects by top architectural firms from the Oracle corporate campus in Silicon Valley to the Riverwalk in Monterey, Mexico.
- 55. Driver Information Load. 2003. Pennsylvania Transportation Institute, Pennsylvania State University. United States Sign Council.
 - i. This report includes current research findings regarding the presence of roadside signs and their potential impact on driver performance.
- 56. Dudek, C.L. 1991. Guidelines on the use of changeable message signs. Final Report - DTFH61-89-R-00053. 269p. U.S. DOT Federal Highway Administration, Washington, D.C.
 - i. Abstract:
 - ii. The 1986 FHWA publication "Manual on Real-Time Motorist Information Displays" provides practical guidelines for the development, design, and operation of real-time displays, both visual and auditory. The emphasis in the Manual is on the recommended content of messages to be displayed in various traffic situations; the manner in which messages are to be displayed--format, coding, style, length, load redundancy, and number of repetitions; and where the messages should be placed with respect to the situations they are explaining. This report is intended to provide guidance on 1) selection of the appropriate type of Changeable Message Sign (CMS) display, 2) the design and maintenance of CMSs to improve target value and motorist reception of messages, and 3) pitfalls to be avoided, and it updates information contained in the Manual. The guidelines and updated information are based on research results and on practices being employed by highway agencies in the United States, Canada and Western Europe. CMS technology developments since 1984 are emphasized. Since the use of matrix-type CMSs, particularly light-emitting technologies, has increased in recent years. Matrix CMSs have received additional attention in this report. The report concentrates on design issues relative to CMSs with special emphasis on visual aspects, but does not establish specific criteria to determine whether to implement displays. The intent is to address display design issues for diverse systems ranging from highly versatile signing systems integrated with elaborate freeway corridor surveillance and control

operations to low cost, less sophisticated surveillance and signing systems intended to alleviate a single specific problem.

57. Dudek, C.L. 1997. Changeable message signs. NCHRP Synthesis of Highway Practice. 237.
 - i. Abstract:
 - ii. This synthesis will be of interest to traffic engineers in federal, state, provincial, and local transportation agencies that are responsible for the design and operation of safe and efficient highway systems. It will also be useful to consulting traffic engineers, sign manufacturers, and vendors in the private sector who assist governmental clients in the application of changeable message sign (CMS) and other intelligent transportation systems (ITS) technology. It is an update of NCHRP Synthesis No. 61 (1979). It describes the various types of permanently mounted CMSs in use in the United States and Canada. This technology, also referred to as "variable message signs" or "motorist information displays", is in widespread use in North America. This report of the Transportation Research Board provides information on the various CMS types in use, their typical characteristics, including the technology types, the character (letters and numbers) types and size, and conspicuity. The synthesis presents a discussion on the types of messages used when there are no incidents. Other aspects, such as procurement, maintainability, and warranties are also discussed.
58. Dudek, C; Trout, N; Booth, S; Ullman, G. 2000. Improved dynamic message sign messages and operations. Texas Department of Transportation Final Report No. FHWA/TX-01/1882-2,
 - i. Abstract:
 - ii. This report provides the results of an extensive laboratory investigation of a total of 15 specific issues related to dynamic message sign (DMS) operations statewide. These issues were identified and approved by the Texas Department of Transportation project advisors responsible for DMS operations in their respective districts. Laptop computers were used to simulate DMS message displays. After each message display, participating subject drivers responded to questions designed to determine the level of recall and comprehension of the information contained in the message. Response times as well as message format/sign operating preferences were also collected from the subject drivers. The report contains specific recommendations concerning DMS issues in the following four categories: (1) communicating time and day for future roadwork to motorists; (2) motorist interpretations of specific words or phrases used on DMSs; (3) DMS operating practices; and (4) using DMSs with lane control signals.

59. Dudek, C.L. and Ullman, G.L. 2002. Flashing messages, flashing lines, and alternating one line on changeable message signs. Transportation Research Record No. 1803: 94-101.
- i. Abstract:
 - ii. Results of human factors laboratory studies conducted in Texas pertaining to the display of messages using the following dynamic characteristics of changeable message signs (CMSs) are presented: (a) the effect of flashing an entire one-frame message, (b) the effect of flashing one line of a one-frame message; and (c) the effect of alternating text on one line of a three-line CMS while keeping the other two lines of text the same. Two hundred sixty Texas drivers were recruited in Dallas, El Paso, Fort Worth, Houston, and San Antonio to participate in the laboratory studies designed to simulate these CMS characteristics on laptop computers. The drivers responded to questions designed to determine the level of recall and comprehension of the information contained in the message. Response times, message format, and sign operating preferences were also collected. The results showed that in the laboratory setting, flashing a oneframe message did not adversely affect driver recall or comprehension to a significant degree compared with when the message was not flashed. However, average reading times were significantly higher when the message was flashed. Flashing one line of a three-line message appeared to adversely affect recall of parts of the message. In addition, average reading times were significantly higher for the flashing line message. Alternating one line of text and keeping the other two lines constant did not adversely affect message recall. However, average reading times increased significantly.
60. Duerksen, C.J. 1999. *Aesthetics, Community Character, and the Law*. Chicago: American Planning Association.
- i. This book helps land-use planners and citizens understand the law of aesthetics and the legal tools available to help their communities maintain their special features and sense of place
61. Durkop, B.R. and Dudek, C.L. (2001). Texas driver understanding of abbreviations for changeable message signs. Transportation Research Record 1748: 87-95.
- i. Abstract:
 - ii. Research was conducted as part of an ongoing project for the Texas Department of Transportation to evaluate the use of changeable message signs (CMSs) in Texas. The objective was to determine motorist understanding of abbreviations for use on CMSs. A human factors study was conducted in six locations in Texas. Participants

were given a list of abbreviations and were asked to interpret the full words or phrases. The results identified 24 abbreviations that were understood at an acceptable level for use on CMSs in Texas; acceptability was based on a criterion of 85% or more of the participants' correctly interpreting the word or phrase. Differences in study location comprehension levels were also examined. Twelve abbreviations were recommended for use only at particular locations on the basis of the varying comprehension levels among the six study locations. Abbreviations that were understood by less than 85% of the participants were not recommended for use in Texas.

62. Easterby, R. S., & Graydon, I.R. 1981a. *Evaluation of public information symbols, ISO tests: 1979/80 series, part I: appropriateness ranking tests*. (AP Report 99). Birmingham, England: Applied Psychology Department, University of Aston.

Easterby, R. S., & Graydon, I.R. (1981b). *Evaluation of public information symbols, ISO tests: 1979/80 series, part II: comprehension/recognition tests*. (AP Report 100). Birmingham, England: Applied Psychology Department, University of Aston.

- i. In relation to iconic signage on an international scale, these publications include a study on the universal understanding of 108 international symbols, 32 of which are widely used. The results depicted that fewer than half of the subjects clearly understood what 86 of the symbols represented and only three symbols were identified by more than two-thirds of the sample. This study emphasizes the importance of considering the audience or consumers in the development of signs to ensure the recognition and comprehension of the symbols involved.

63. Editors from Signs of the Times. 2006. *Commercial Sign Techniques Step-by-Step*. ST Publishing, Inc.

- i. Description:
- ii. With more than 250 full-color photos, this book covers the techniques used by the world's leading signmaking experts to fabricate the kinds of signs commercial sign shops make every day: vinyl graphics, signs and banners; carved, painted and gilded signs; pinstriped vehicles; screen printed flat signs. Learn different techniques and diversify your business. Also includes gallery photos for ideas and resource list of manufacturers and product distributors.

64. Eiseman, L. 2006. *Color: Messages & Meanings*. Hand Books Press.

- i. Description:

- ii. This book, a PANTONE Color Resource, contains all new material to help make effective, unique and credible color choices. Based on research and filled with hundreds of color combinations and illustrations, this book presents color expert, Eiseman's insights on color and emotion, and addresses how best to integrate these qualities into your work, insuring your intended message is communicated.
65. Electrical General Study Guide. 2008. International Association of Electrical Inspectors.
- i. Abstract:
 - ii. The Electrical General Study Guide has been painstakingly updated to the 2008 National Electrical Code. Questions are formulated to be similar to test formats you are likely to find in the electrical inspector certification examinations.
66. Evans, G. 2003. Hard-branding the cultural city - From Prado to Prada. *International Journal of Urban and Regional Research* 27(2). June, pp. 417-440.
- i. Abstract:
 - ii. The industrial 'Event City', host to World Fair, sporting, cultural and ceremonial mega-event, has been transformed in its late-capitalist form into the 'City as Event'- from the all year round festival city to the ubiquitous 'Cities of Culture'. These self-styled culture cities now look to the contemporary art museum and cultural district to provide a cosmopolitan edge to their promotional icons and associations, with Art now acknowledged as an 'industry'. Cities worldwide, irrespective of their indigenous culture and heritage (e.g. Guggenheim Bilbao, Rio "et al".), are thus emulating the brand reinforcement witnessed in leisure and entertainment products and themed experiences, which themselves have entered the retail environment as prime urban consumption spaces. The paper critiques this evolution of the city of culture and the branded art facility in terms of their form and function, arguing that form has followed regional funding, and that culture-led regeneration and place-making now mirrors the product branding of Nike and Sony, vying with them for consumer and political attention through the use of star architecture and retail strategies that belie their public good/realm and cultural distinctions. The cost of these flagships and cultural strategies, the paper concludes, is borne in terms of cultural diversity and production versus consumption and mediation; in community cultural activity and amenity; and by those who do not have a stake in the gentrification process which attaches to these globalized "grand projects" Copyright Joint Editors and Blackwell Publishers Ltd 2003.
67. Evans, W. 1998. *Walker Evans: Signs / with an essay by Andrei Codrescu*. Los Angeles: The J. Paul Getty Museum.

- i. This publication includes pictures of signage from the 1920s until 1975 America as Andrei Codrescu “trains a perceptive eye on the artistic and social climate in Evans’ America and reflects on the photographer’s images as documents and commentary. Photographer Walter Evans’ passion for signage seeps through this collection of modern America signs- from billboards to gas station pumps to street graffiti to handmade announcements of a Saturday-night dance. This book includes 50 of his photographs of signs from the Getty Museum’s collection.
- 68. The Federal Highway Administration (FHWA)
 - i. FHWA provides extensive information on highway design, construction, and maintenance (www.fhwa.dot.gov/).
- 69. FHWA. 1996. Uniform traffic control and warning messages for portable changeable message signs. FHWA-RD-95-173, Summary Report.
 - i. Abstract
 - ii. The purpose of this study was to develop and test word and symbol traffic control and hazard warning messages for use on portable changeable message signs (PCMSs). The literature was reviewed, State highway engineers were interviewed, PCMS manufacturers were surveyed, and motorists were questioned to develop an extensive list of candidate PCMS messages for subsequent evaluation during the laboratory and field-testing. More than 800 messages were identified for 30 situations. The laboratory studies were conducted to identify those key words or phrases that the motorist felt were most effective. Field tests, both daytime and nighttime, were conducted for candidate messages that lacked a clear winner during the laboratory studies. Also six symbol messages were shown during the field tests to evaluate motorist comprehension of these messages. This summary report presents some of the research results. The full report, which has the same title as this summary report, is FHWA-RD-95-171 (TRIS 00720253).
- 70. FHWA. 2001. Research review of potential safety effects of electronic billboards on driver attention and distraction. Federal Highway Administration Final Report. Report No. FHWARD- 01-071. Available at <<http://www.fhwa.dot.gov/realestate/elecbbird/index.htm#contents>>.
 - i. Abstract:
 - ii. Advances in outdoor display technology, and decreases in cost, support an interest in expanding deployment of high resolution and dynamic imaging in outdoor advertising. This raises questions on the effects that electronic billboards (EBBs) and other dynamic signs such as tri-vision signs may have on driver distraction. The purpose of this report is to present a review of the literature on the safety

implications of electronic billboards, to identify knowledge gaps in the findings of the review, and to develop a research plan to address the knowledge gaps. The general approach in this review was to identify information about potential safety implications of EBBs. Factual data regarding billboard safety were sought through a review of existing research literature and information obtained from government staff. Because driver distraction is of interest in other areas of research, such as cellular telephone use and in-vehicle visual information equipment, the present report examines these areas for possible cross-fertilization results. The report concludes with a set of research questions and research findings that are directed to the safe design of dynamic billboards.

71. FHWA. 2003. Portable changeable message sign handbook: PCMS. FHWA-RD-03-066. McLean, VA 22101.

- i. Abstract:
- ii. A portable changeable message sign (PCMS) is a traffic control device that is capable of displaying a variety of messages to inform motorists of unusual driving conditions. This capability is achieved through elements on the face of the sign that can be activated to form letters or symbols. The message is limited by the size of the sign (usually three lines with eight characters per line). A PCMS is housed on a trailer or on a truck bed and can be deployed quickly for meeting the temporary requirements frequently found in work zones or accident areas. The purpose of this handbook is to present basic guidelines for the use of PCMSs. This handbook presents information on the PCMS and is intended to illustrate the principles of proper PCMS use.

72. Ferm's Fast Finder. 2005 and 2008. International Association of Electrical Inspectors.

- i. Abstract:
- ii. Historically, Ferm's Fast Finder has been the leading guidebook, with its comprehensive directions, advice and information, to the National Electrical Code. Its comprehensive cross-reference index has been meticulously updated to NEC-2008. Each entry, reference and source has been examined for precise detail and ease of use. Volume 1 contains detailed crisscross references, gives many avenues of approach to each subject, and includes a special section that cross-references the International Residential Code (IRC) with the National Electrical Code. Volume 2 has nearly 200 extensive and practical rules of thumb, formulas, illustrations, tables, charts and diagrams for the reader's convenience. Serviceable and beneficial, Ferm's Fast Finder is a must-have for those who seriously study the codes.

73. Filippidis, L., Galea, E.R., Gwynne, S. & Lawrence, P.J. 2006. Representing the Influence of Signage on Evacuation Behavior within an Evacuation Model. *Journal of Fire Protection Engineering* 16(1) 37-73.
- i. This study describes the concept of the Visibility Catchment Area or VCA as it is linked to a prototype behavior model intended to represent the occupant's interaction with the signage system. The research simulates various evacuation scenarios within a hypothetical supermarket layout in order to test the functionality and performance of the newly developed model.
74. Finke, G. D. 1994. *City Signs: Innovative Urban Graphics*. New York: Madison Square Press.
- i. This book deals with the design of signs and signboards. It also explores the role of sign designs as commercial art in the United States of America.
75. Finke, G.D. 1999. *You are Here: Graphics that Direct, Explain & Entertain*. Cincinnati: ST Publications.
- i. A review of case studies in the United States of signs and wayfinding aids.
76. Finley, M.D., Wooldridge, M.D., Mace, D, and Denholm, J. 2001. Photometric requirements for portable changeable message signs. Texas Department of Transportation, TX-02/4940-2. Research Report 4940-2, TTI: 7-4940.
- i. Abstract:
 - ii. Portable changeable message signs (PCMSs) are traffic control devices that advise motorists of unexpected traffic and routing situations. In contrast to static signing, PCMSs convey dynamic information in a variety of applications, such as work zones, incident management, traffic management, and warning of adverse conditions. Although PCMSs have been used in traffic control applications for many years, there are no established photometric standards for the device that can be used as the basis for a procurement specification. The only provision related to the visibility of PCMSs is a requirement in the "Texas Manual on Uniform Traffic Control Devices for Streets and Highways--Part VI" which indicates that PCMSs be visible from at least a half mile (under ideal day and night conditions) and the sign message is legible at a minimum of 650ft. However, the manual does not provide a means for determining whether PCMSs meet these criteria. This project reviewed the performance of PCMSs and developed photometric standards to establish performance requirements. In addition, researchers developed photometric test methods and recommended them for use in evaluating the performance of PCMSs. This report includes a review of the literature and provides documentation for the standards and procedures recommended.

77. Fitzgerald, B. 1978. *Practical Sign Shop Operation*. Cincinnati: The Signs of the Times Publishing Co.
- i. This book serves as a guide to producing signs covering topics from operating your own shop, and tools of the trade, to designing the sign, choosing sign lettering, and erecting the sign.
78. Flad, H.K. 1997. Country clutter: visual pollution and the rural roadscape. *The Annals*, 553: 117-129.
- i. Abstract:
 - ii. The landscape of rural America has been profoundly influenced by social, cultural, and economic changes. The rural roadscape is a visible text of these changes, and the transportation palimpsest a cultural text of the American ideal of mobility. This article briefly examines the growth of the presence of the automobile and the automobile's role in changing the face of rural America, with an emphasis on the aesthetics of the roadscape. In the late twentieth century, a concern for the visual environment has become an important part of environmental assessment, and selected aspects of roadside visual pollution, particularly signs, are examined, especially as they relate to federal and state legislation concerning billboards. Lastly, public and private sector efforts to preserve and enhance cultural and historical rural landscapes, through such measures as the designation of scenic roads, is presented as an example of more holistic transportation planning.
79. Fleming, R. L., Goldsmith, R. & Chewning, J.A. 1994. *Saving Face: How Corporate Franchise Design Can Respect Community Identity*. Chicago: American Planning Association.
- i. This report covers the design implications of marketing strategies in gasoline and fast-food industries, a visual essay on design alternatives, and five success stories. It highlights the importance of considering a sense of local identity and preserving the community character when implementing signage.
80. Fontaine, M.D. 2003. Guidelines for application of portable work zone intelligent transportation systems. *Transportation Research Record No1824*: 5-22.
- i. Abstract:
 - ii. Work zone intelligent transportation systems (WZITSs) are promoted as a way to improve safety and reduce congestion at work zone locations where traditional traffic management centers do not exist. These systems usually integrate portable changeable message signs and speed sensors with a central control system that automatically determines appropriate messages that are based on current traffic conditions. Manufacturers of these systems claim that WZITSs can warn drivers of downstream congestion, alert drivers to slower speeds ahead, and suggest alternate

routes on the basis of prevailing conditions. Transportation agencies are often asked to make decisions on the installation of a WZITS without the benefit of objective information on its expected performance. Relatively few operational tests of these systems have been performed, and the results are not always well documented or conclusive. Agencies need guidance to help them determine whether a WZITS system would improve safety and operations at a specific site. Applications of WZITSs are reviewed, and a series of guidelines for their deployment, based on lessons learned from past tests, is presented.

81. Franklin, W. 2004. *Signs in America's Auto Age: Signatures of Landscape and Place*. Iowa City: University of Iowa.
 - i. This book covers the topics of commercial signs including signs downtown, on main street, and roadside signs; signing in public spaces; sign regulation; signing personal space; and sign aesthetics.
82. Frascara, J. 2004. *Communication Design: Principles, Methods, and Practice*. New York: Allworth Press.
 - i. This book outlines the field of communication design, its areas of concern, its working methods, and its purposes. It centers on visual communication design as a "human communication problem- not as a technological problem- and focuses on essential aspects of the profession and of the education of designers.
83. Frascara, J. 2006. *Designing Effective Communications: Creating Contexts for Clarity and Meaning*. New York: Allworth Press.
 - i. This book focuses on extending the range of concerns of communication designers so that, in addition to crafting messaging and signage, designers become conscious of the audience of such designs. This publication adds to the theory of communication design as it creates new possibilities for effective communication through design.
84. Frascara, J. 2004. *Communication Design: Principles, Methods, and Practice*. New York: Allworth Press.
 - i. This book outlines the field of communication design, its areas of concern, its working methods, and its purposes. It centers on visual communication design as a "human communication problem- not as a technological problem- and focuses on essential aspects of the profession and of the education of designers.
85. Frascara, J. 2006. *Designing Effective Communications: Creating Contexts for Clarity and Meaning*. New York: Allworth Press.

- i. This book focuses on extending the range of concerns of communication designers so that, in addition to crafting messaging and signage, designers become conscious of the audience of such designs. This publication adds to the theory of communication design as it creates new possibilities for effective communication through design.
- 86. Fraser, J. 1997. *The American Billboard: 100 Years*. Harry N. Abrams Publishing, Inc. Outdoor Advertising Association of America.
 - i. This publication includes a historical and pictorial documentation of the billboard industry's first one hundred years.
- 87. Garvey, P. M. *Environmental Impact of On-Premise Sign Lighting, with respect to potential light trespass, sky glow, and glare*. 2004. The United States Sign Council Foundation. Pennsylvania State University Park.
 - i. This academic research project investigates the actual and perceived effect of varied types of illuminated signs on the dispersion of light in the nighttime environment, concluding that on-premise signs have minimal effect when current norms of measurement for light trespass, sky glow, and glare are employed.
- 88. Garvey, P.M. and Mace, D.J. 1996. *Changeable message sign visibility*. Federal Highway Administration Report No: FHWA-RD-94-077, Final Report.
 - i. Abstract:
 - ii. The object of this contract was to identify problems with the visibility of changeable message signs (CMSs), particularly for older drivers, and to develop design guidelines and operational recommendations to ensure adequate conspicuity and legibility of in-service CMSs. This project was divided into three main sections: a field survey of in-use CMSs, a series of laboratory experiments and static field studies, and a partially controlled dynamic field study. The research was designed to optimize CMS components, including the character variables (font, width-to height ratio, color, and contrast orientation) and the message variables (inter-letter, inter-word, and inter-line spacing).
- 89. Garvey, P. M. & Pietrucha, M. T. 2005. *Electronic Message Center Research Review*. The United States Sign Council Foundation. Pennsylvania State University Park.
 - i. This publication provides a compilation of currently available research concerning the use, function, safety, and regulation of Electronic Message Center signs. This document provides research designed to answer questions from both users and regulators in addition to providing information concerning the effectiveness and safety of Electronic Message Centers.

90. Garvey, P. M., Pietrucha, M.T., & Cruzado, I. 2009. The Effects of Internally Illuminated On-Premise Sign Brightness on Nighttime Sign Visibility and Traffic Safety. The United States Sign Council Foundation. Pennsylvania State University Park.
 - i. This academic research project compares daytime and nighttime visibility of on-premise internally illuminated signs. The investigation uses seven different levels of internal sign illumination displayed to subjects to evaluate the impact of varying sign brightness levels on the nighttime visibility of internally illuminated signs. The study also studies the consequent safety effects of varying sign brightness levels in terms of driver reaction time and distance.
91. Garvey, P. M., Pietrucha, M.T., & Cruzado, I. 2009. Internal vs. External On-Premise Sign Lighting, visibility and safety in the real world. The United States Sign Council Foundation. Pennsylvania State University Park.
 - i. This academic research project includes a real world field study investigating the difference in visibility and legibility between internal and external on-premise sign illumination utilizing signs in actual roadside environments identical in all design aspects except for the method of illumination. The findings show that under real world conditions, internally illuminated signs performed significantly better than the 40 to 60 percent advantage shown by previous test track studies. The results of these tests produced an average of 70 percent visibility in addition to driver reaction time advantage, all correlating into quantifiable traffic safety benefits.
92. Garvey, Philip M., Ramaswamy, C., Ghebrial, R, De la Riva, M., & Pietrucha, M. T. 2009. Relative Visibility of Internally and Externally Illuminated On-Premise Signs. The United States Sign Council Foundation. Pennsylvania State University Park.
 - i. This academic research project investigates the differences in both visibility and legibility between internally illuminated and externally illuminated (including dimensional) on-premise signs. Results of extensive day and night field tests provide confirmation that internal sign illumination, on average, provides 40% greater visibility and 60% greater legibility than that provided by external sign illumination.
93. Glassford, P. 1983. *Appearance Codes for Small Communities*. Chicago: American Planning Association.
 - i. This report emphasizes the significance of regulating for better design in small communities. It offers a legal framework for implementing appearance review procedures and reviews several cautions to consider in the matter of signage.
94. Grounds, S & Morris, B. 1998. Great Outdoor. Outdoor Advertising Association of America.

- i. This book serves as a guide to writing and designing superior outdoor advertising. Two award-winning agencies from London analyze dozens of designs to demonstrate how each concept is brought to life. Images are in full color.
- 95. Guerrier, J. and Wachtel, J. 2001. A simulator study of driver response to changeable message signs of differing message length and format (abstract only). *Driving Assessment 2001: The First International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*. Aspen, Colorado.164-165.
 - i. Abstract:
 - ii. Highway congestion nationwide continues to increase, and three Florida urban areas rank among the top ten. Florida has been studying and implementing intelligent transportation system technologies to address its congestion problems, with a focus on its special populations such as the elderly and multi-cultural groups for which English is not the primary language. One of these technologies most widely deployed is the changeable message sign (CMS). Fifty-two CMSs are operational in Florida, with 39 more scheduled for deployment soon. Although CMSs have the potential to facilitate travel, certain issues must be considered to ensure that they do not exacerbate the congestion problem. One key CMS operational issue is the number of phases required to present a complete message. "On-time" for two-phase messages varies from 2.5 to 5 seconds per phase across the State. Of course, the appropriateness of this on-time depends not only on the characteristics of the CMS itself, but on the road, traffic and weather conditions, and driver characteristics. This study, funded by the National Institute on Aging, investigated issues related to the number of CMS phases and their on-time. The authors used a low-cost, interactive driving simulator supplemented with a video monitor above the main display. While simulator screens presented interactive road and traffic conditions, the supplemental monitor displayed the CMS. Young and old drivers drove the simulator under different workload conditions and responded to road closure/detour information on the CMS. All CMS displays were developed in accordance with accepted guidelines and were reviewed for content by independent experts. Results showed consistent and significant age effects across all tested conditions. In addition, the authors found significantly poorer response for all drivers under the two-phase CMS, despite the fact that the message "on-time" was nearly 2 seconds longer than that used in two major Florida jurisdictions. The findings have implications for CMS design and operation in Florida and in other jurisdictions with similar populations.
- 96. *Guideline Code For Regulation of On-Premise Signs*. 2001. United States Sign Council.

- i. This document is a comprehensive model of suggested means appropriate for local regulation of on-premise signs, including definitions, general sign types, size computation methodologies, area limitations and calculation charts, and specific regulation of sign types by zone.
- 97. Guidelines for Selection of Speed Reduction Treatments at High-Speed Intersections. Transportation Research Board National Cooperative Highway Research Program (NCHRP) Report 613. Project NCHRP 03-74. Posted on July 24, 2008.
 - i. Description:
 - ii. TRB's National Cooperative Highway Research Program (NCHRP) Report 613: Guidelines for Selection of Speed Reduction Treatments at High-Speed Intersections explores the effectiveness of geometric design features as well as signage and pavement markings to reduce vehicle speeds at high-speed intersections. A final report documenting the entire research effort is available online as NCHRP Web-Only Document 124.
- 98. Guidelines for Selection of Speed Reduction Treatments at High-Speed Intersections: Supplement to NCHRP Report 613. Transportation Research Board National Cooperative Highway Research Program (NCHRP) Report 613. Project NCHRP 03-74. Posted on July 24, 2008.
 - i. Description:
 - ii. TRB's National Cooperative Highway Research Program (NCHRP) Web-Only Document 124: Guidelines for Selection of Speed Reduction Treatments at High-Speed Intersections documents the research efforts associated with production of NCHRP Report 613 that explores the effectiveness of geometric design features as well as signage and pavement markings to reduce vehicle speeds at high-speed intersections.
- 99. Hale, D. 2005. How to Estimate & Price Signs. ST Publications.
 - i. Description:
 - ii. This new book provides information on how to arrive at your own pricing, based on cost estimates, predetermined mark-ups and profit margins. Once you've learned how, you can calculate your own prices that will guarantee the profit margin you want. Also includes a chapter on how leasing signs benefits both you and your customer.
- 100. Harder, K.A., Bloomfield, J., and Chihak, B.J. 2003. The effectiveness and safety of traffic and non-traffic related messages presented on changeable message signs (CMS). Minnesota Department of Transportation MN/RC-2004-27 Final Report.
 - i. Abstract:

- ii. The objectives of this study investigating Changeable Message Signs (CMS) were to determine whether or not CMS messages really work, whether or not they cause traffic slow downs, and whether or not they have an impact on traffic flow. The participants were 120 licensed drivers from three age groups--18-24, 32-47, and 55-65 years old. Two experiments were conducted in a fully-interactive, PC-based STISIM driving simulator. Experiment One investigated the effectiveness of the following message, "CRASH/AT WYOMING AVE/USE THOMPSON EXIT." In Experiment Two, the final CMS message was: "AMBER ALERT/RED FORD TRUCK/MN LIC# SLM 509." Results were as follows: In Experiment Two, only 8.3% of the participants had Excellent AMBER Recall Scores, while 51.7% has Good scores. Gender significantly affected the AMBER Recall Scores--there were more females than males in the Excellent Category. A greater proportion of those who knew what AMBER Alert meant were in the Excellent and Good Categories. 21.7% of the participants slowed down by at least 2 mph. Whether or not traffic delays will result from drivers slowing to read AMBER Alerts in real life will depend on the extent of the slow downs and on current traffic density. In Experiment One, 55.8% of the participants took the Thompson Exit after seeing the Thompson Exit Message. Of the 53 participants who did not take the exit (1) 35.9% ignored the CMS message because they did not think that it applied to them; (2) 35.9% did not understand the CMS message; and (3) 22.5% did not notice the message. (It is not known why 5.7% of the 53 did not take the exit.) Changes to the wording of the messages are recommended.

101. Hazardous Locations, 1E. 2005. International Association of Electrical Inspectors.

- i. Abstract:
- ii. This book focuses on how essentially, hazardous locations code rules focus on keeping fuel sources separated from ignition sources (electrical current). This involves removal of at least one leg of the fire triangle. This text reveals how this is done carefully and methodically.

102. Hazardous Locations, 2E. 2008. International Association of Electrical Inspectors.

- i. Abstract:
- ii. This book focuses on how essentially, hazardous locations code rules focus on keeping fuel sources separated from ignition sources (electrical current). This involves removal of at least one leg of the fire triangle. This text reveals how this is done carefully and methodically.

103.Henkin, D. 1998. *City Reading: Written words and public spaces in antebellum New York*. New York: Columbia University Press.

- i. Abstract:
- ii. Cultural historian David Henkin explores the role of the act of reading in New York City's public life between 1825 and 1865. From the opening of the Erie Canal to the end of the Civil War, New York became a metropolis, and demographic, economic, and physical changes erased the old markers of continuity and order. The 'ubiquitous urban texts'--from newspapers to paper money, from street signs to handbills--became both indispensable urban guides and apt symbols for a new kind of public life that emerged first in New York. *City Reading* focuses on four principal categories of public reading: street signs and store signs; handbills and trade cards; newspapers; and paper money. Drawing on a wealth of visual sources and written texts that document the changing cityscape--including novels, diaries, newspapers, municipal guides, and government records--Henkin shows that public acts of reading (to a much greater extent than private, solitary reading) determined how New Yorkers of all backgrounds came to define themselves and their urban community.

104.Heikenfeld, J. C. 2003. Rare earth-doped gallium nitride flat panel display devices. Cincinnati: University of Cincinnati.

- i. Abstract:
- ii. GaN has excellent high field transport characteristics, is chemically and thermally rugged, and incorporates well the RE dopants. With preliminary optimization of GaN:RE phosphors and proper design of EL device structure, GaN:RE phosphors have been advanced in luminous efficiency by two orders of magnitude, to nearly within an order of magnitude of commercially required display efficiencies (~ 1 lm/W).GaN:RE phosphors have been operated in direct current and alternating current thin film electroluminescent device structures. Alternating current GaN:RE EL devices require GaN deposition on amorphous dielectric layers which prevent catastrophic breakdown of the EL display devices at high operating voltage. Alternating current GaN:RE EL devices have been shown compatible with commercial display fabrication techniques, such as formation on low-cost transparent glass substrates. GaN:RE phosphors have also been implemented in a thin/thick film/ceramic substrate hybrid structure which is promising for high yield, large area (>17" diagonal), full color displays which can be manufactured at less than half the cost of plasma displays. Using some of the specific advantages of GaN:RE

phosphors, such as high temperature stability, GaN:RE thin film phosphors have been integrated with a novel display technique which advantageously combines utilization of standard flat panel display glass substrates and high-yield screen printing of a high permittivity thick film dielectric layer. Operation lifetimes exceeding 1000 hrs at >95% initial brightness have been achieved. This novel display structure has also been advanced to very high contrast device operation.

105.Hingst, Jim. 2007. Vinyl Sign Techniques. ST Publishing.

- i. This book is divided into four sections: sales & marketing, materials, fabrication, and vinyl application & removal. Important aspects to running an efficient and profitable vinyl sign business is covered in detail, often including valuable charts, tables and photos for reference.

106.Hitchins, D 2001. Lowercase font set development for variable message signs (VMS). 8thWorld Congress on Intelligent Transport Systems.

- i. Abstract:
- ii. Current Transit New Zealand (road controlling authority in New Zealand) policy dictates that within the most heavily congested sections of the Auckland motorway system, Variable Message Signs (VMS) are used only to display traffic related messages. When not doing so they remain blank. For some, this policy has been of concern, since when a VMS is blank drivers cannot tell whether it is working or not, and therefore whether traffic conditions are normal. The counterargument to this is that VMS illuminated with unimportant information may cause unnecessary distraction to motorists. Also, if signs are displaying a message of some sort all of the time; drivers might not read the messages at all in time, on the basis that they are rarely important. One method of overcoming this problem is to display familiar safety messages on selected VMS using lower case font. This will enable drivers to perhaps distinguish general safety messages from important road related information, which is normally displayed using upper case font. The benefits, costs and risks associated with current Transit practice has yet to be quantified. Empirical studies to gain a better understanding of driver behavior and response to this practice is currently underway and will aim to investigate and identify a range of options available for extended display on VMS, along with their likely impacts.

107.Holick, A.J. 2000. Development of portable variable message sign user guidelines for common applications. Compendium: papers on advanced surface transportation systems: 89-120.

- i. Abstract:

- ii. This report focuses on the development of guidelines for the use of portable variable message signs (PVMS). The guidelines are designed to assist users in properly placing the PVMS and message displays. Information was collected on researched guidelines and state DOT operators' manuals and the results were compared. A draft set of user guidelines based on these comparisons was then produced. The guidelines covered the following areas: process, audience, purpose format, logical order, visual inspection, and terminating and updating messages.
- 108.Holland, D.K. 2001. *Design Issues: How Graphic Design Informs Society*. New York: Allworth Press.
- i. This publication centers on issues of communication within the study graphic design. Such expertise is needed in the process of publishing, packaging, way-finding, corporate identity, promotion, and advertising to help develop approaches to their visual communications.
- 109.Horsley, P. 1981. *Sign Structures & Foundations: A Guide for Designers and Estimators*. Cincinnati: Signs of the Times Publishing Co.
- i. This book focuses on the construction and economic aspects of signage. It covers topics such as concrete bases, steel pylon structures, single-face signs, multi-face signs, rotating signs, mechanical animation, illuminated letters, and installation.
- 110.Huchingson, R.D. and Dudek, C.L. 1983. How to abbreviate on highway signs. *Transportation Research Record*, No. 904: 1-4.
- i. Abstract:
 - ii. This study investigated abbreviations for 80 traffic-related words by having a sample of drivers compose abbreviations and then having a different sample identify the word after being given the most popular abbreviation. Abbreviations were classified by percentage of subjects who correctly identified the words when presented alone and, again, when presented in the context of another word. The study identified strategies employed in abbreviating words, explored the relation between highly stereotyped abbreviations and success in understanding them, and recommended a set of abbreviations that likely could be used successfully on changeable message signs.
- 111.Hunt, W., Rosentsweig, G. & La Brecque, E. 1994. *Designing & Planning Environmental Graphics*. New York: Madison Square Press.
- i. This book discusses the growing field of environmental graphic design which has come to include not only signs on buildings, but the entire environment. It is a field involving building developers, retailers, city planners, architects, and facility

managers. This publication is a response to the noted lack of a substantial body of literature and documentation on the subject.

112. ISA Aluminum Sign Welding Guide. 2008. International Sign Association.

- i. This publication offers a reference to sign engineers, shop managers and qualified welders to ensure designs and procedures meet all industry standards and requirements for welding quality as detailed in AWS D1.2. It was developed specifically for sign manufacturers or any company that includes welding in its shops.

113. Jacobson, R. E. 2000. *Information Design*. Cambridge: Massachusetts Institute of Technology Press.

- i. The contributors of this book maintain that the success of a design depends crucially on the specific setting in which it is applied and on the goals and expectations of the users. They offer methods, such as sense-making and way-finding, of how information design can be achieved in a manner that is not only beneficial to consumers and producers but also ways in which designing can be produced diligently and ethically. This text contributes to the design aspect of signage and the process of constructing successful visuals of communication.

114. Jones, B. PE. 1998. *Engineering Sign Structures*. ST Publications, Inc.

- i. Description:
- ii. For years there has been a critical demand within the sign industry for a book on the structural engineering of signs. This comprehensive text more than meets that demand - it exceeds it. Sign companies, structural engineers and public agencies charged with regulating building construction will all benefit from the detailed contents: Engineering perspective, analysis, practices, history; Freestanding sign structures, load effects, resultants, and columns; Connections, structural bolts and welds, column splices, base plates and anchor bolts; Footings for sign columns, soils, structural concrete, pier and spread footings; Internal sign cabinet frames, cantilever arms and torsion beams; Building signs, wall sign anchorage, wooden post signs; and Computer-aided engineering, spreadsheets, and finite element analysis. It also includes the fundamental mathematics for readers not already familiar with engineering calculations. The author presents more than 220 figures and 70 tables with clear, detailed explanations.

115. Jones, D.K. *Sign-Permit Fees: How Much is Too Much?* Alexandria: National Electric Sign Association.

- i. This publication includes a survey of permit fees from sample cities throughout the nation and research on the legal standards applicable to sign-permit fees led by the

National Electric Sign Association (NESA) in response to complaint from its members on permit fees.

116. Jones, S.L. Jr., and Thompson, M.W. 2002. State of the practice for displaying non-traffic related messages on dynamic message signs. *Today's Transportation Challenge: Meeting Our Customer's Expectations*. Institute of Transportation Engineers.

- i. Abstract:
- ii. Dynamic message signs (DMS), also referred to as changeable message signs (CMS) and variable message signs (VMS), have been used for over 30 years to provide traffic information to motorists and have become a prominent component of intelligent transportation systems (ITS). They have become an important component of many advanced traveler information and traffic management systems. DMS allow for the dissemination of real-time traffic information to motorists and are generally deployed in urban areas to inform motorists of traffic conditions (e.g., expected delays, estimated travel times, diversion routes, lane closures). DMS have become an important source of motorist information during incidents, special events, and work zone traffic control. The value of DMS, or any traffic information source, is dependent on two items: (1) The accuracy and usefulness of the information disseminated; (2) Motorists' willingness and ability to understand and utilize the information. The latter point involves the public perception of traffic information technologies. The quality of traffic-related messages as well as the overall presence of DMS affects the public perception. Traffic management agencies must understand that DMS affect public perception even when they are not actively conveying traffic-related information. Motorists may perceive blank signs as inoperable or may question the allocation of resources to technologies that seem to be (from their perspective) underutilized. On the other hand, displaying information not germane to real-time traffic conditions may erode the credibility of DMS and reduce their effectiveness as a traffic management tool. The purpose of the research presented herein was to assess the professional opinion regarding DMS usage during normal traffic conditions.

117. Kang, T.J. and Muter P. 1989. Reading dynamically displayed text. *Behavior & Information Technology*, 8(1):33-42.

- i. Abstract
- ii. Two experiments were carried out to find an optimal electronic text display method given limited display space. The display formats tested fell into two categories: Times Square, in which text is scrolled from right to left; and rapid, serial, visual

presentation (RSVP), in which text is presented one or several words at a time to a fixed location in the display. Previous studies have indicated that Times Square format is not as efficient as page format display or, by extrapolation, as RSVP. These studies, unlike the present experiments, did not include a smooth-scrolling (pixel-by-pixel) condition. In Experiment 1, a comparison was made between multiple-word RSVP and three versions of Times Square format, differing only in the size of the steps by which the display was scrolled. Except for the largest step-size, comprehension was as high in the Times Square condition as in the RSVP condition. The subjects expressed a significant preference for smooth scrolling Times Square over any other condition. Experiment 2 showed that comprehension for smooth scrolling Times Square was at least as high as that for RSVP at presentation rates ranging from 100 to 300 words per minute. Times Square reading is discussed in terms of optokinetic nystagmus (OKN).

118. Kelly, E. D. & Raso, G. J. 1989. *Sign Regulation for Small and Midsize Communities: A Planner's Guide and A Model Ordinance*. Chicago: American Planning Association.
- i. This report addresses substantive issues in sign regulation including sign design in the form of structure, dimension, location, colors, materials, animated, lighted, enforcement, and content. The text also covers legal issues in sign regulation as well as offering a model sign ordinance.
119. Kinneir, J. 1980. *Words and Buildings: The Art and Practice of Public Lettering*. New York: Whitney Library of Design/Watson-Guptill.
- i. The book includes a history of the art and use of lettering in public spaces focusing on both the visual and functional uses of this public form of communication.
120. Krohe, J. Jr. 2009. *Scroll, Roll, & Flash: Welcome to the world of digital signs*. American Planning Association. April 2009.
- i. Krohe examines the growing number of digital billboard in the United States focusing on the advancements in technology of billboards and the legal issues involved.
121. Lavin, M. 2001. *Clean new world: Culture, politics, and graphic design*. Cambridge: MIT Press.
- i. Abstract:
 - ii. Maud Lavin approaches design from the broader field of visual culture criticism, asking challenging questions about who really has a voice in the culture and what unseen influences affect the look of things designers produce.
122. Lee, K. 2004. Electronic billboard: its influence on public space. Master's Thesis Presented to The Faculty of the Department of Television, Radio, Film and Theatre San Jose State University.

- i. Abstract:
- ii. As an outdoor advertising medium, the electronic billboard, which is a combination of a billboard and television, has been emerging. However, little research has been done concerning the medium. Using multiple methodological approaches, this thesis investigates the influence of the electronic billboard on public space. Initially, it explores the space-altering characteristic of the electronic billboard by examining billboards and television respectively in terms of their relationships with environments. Secondly, it conducted observational research in Times Square, New York, and Shibuya, Tokyo, and recorded the phenomenon of electronic billboards. The information and data gathered from this research are discussed ethnographically and analyzed using typology. Research on this subject reveals that the electronic billboard makes its location placeless by delivering messages, which are not relevant to its geographical origin. In the larger context of urbanization, the electronic billboard represents a birth of anti-geographical place.

123.Lee, S. E., Olsen, E.C.B., and DeHart, M.C. 2003. Driving performance in the presence and absence of billboards. Executive Summary. Foundation for Outdoor Advertising Research and Education. Washington, DC.

- i. Abstract:
- ii. The goal of this project was to ascertain whether or not driving behavior changes in the presence or absence of billboards. Drivers' visual behavior was measured by eyeglance location. In addition, lane deviation and speed changes were noted. The conclusion of the study was that billboards do not cause a change in driving behavior when driving behavior is evaluated in terms of maintenance of speed, visual behavior, or keeping in one's lane.

124.Lewis, D.J. 2000. Photometric requirements for arrow panels and portable changeable message signs. AASHTO Conference Proceedings Juneau, Alaska: 215-221.

- i. Abstract
- ii. Arrow panels and portable changeable message signs are often used in work zones to inform drivers of the need for a lane change or caution. The "Manual on Uniform Traffic Control Devices" (MUTCD) requires that Type C arrow panels have a minimum legibility distance of 1.6 km (1 mi). However, the MUTCD does not provide a subjective means for determining whether an arrow panel meets this criterion. Nor are there industry photometric standards for message panels. The purpose of this project is to develop a reliable and repeatable objective method for measuring the photometrics of arrow and message panels to ensure adequate

performance. The research project tasks include a review of the state of the art, reviews of existing pertinent specifications, development of initial test methods, evaluations of arrow and message panel visibility and the effectiveness of the test methods, revisions and modifications of the test methods, and documentation of research activities and findings. The research findings will be described in a research report and a project summary report. The recommended test methods will be included in both documents.

125. Littlejohn, D. (Ed.) 2003. *Metro Letters: A Typeface for the Twin Cities*. Minneapolis: Design Institute, University of Minnesota, and University of Minnesota Press.
- i. This publication explores an experiment conducted by the University of Minnesota Design Institute to further understand the relationship between typography and urban identity that seeks not to brand the cities themselves but to engage the public's awareness and appreciation of design and typography throughout the metro area.
126. Lopez, E. and Abedon, D. 2001. Operational standards for dynamic message signs. 8th World Congress on Intelligent Transport Systems. Sydney, Australia.
- i. Abstract:
 - ii. The term dynamic message sign is an umbrella classification for numerous intelligent transportation systems (ITS) en-route information sign technologies. Included under this umbrella are: changeable message signs, variable message signs, blank out signs, and lane control signs. This research effort looks at permanent variable and changeable message sign technologies only and will refer to them as "variable message signs (VMS)." With the proliferation of dynamic message signs throughout the United States, are variable message signs being operated and maintained uniformly at a national level, if not, is the overall effectiveness and benefits to the motoring public being compromised? Past experience with static signs has shown that by unifying how signs are installed, operated and maintained the same "look and feel" is created so that all motorists respond to the sign in the same manner regardless of where they are in the nation. With no clear guidance on this issue, state and local agencies are struggling with, and at times developing their own standards on VMS operations. This challenge has led many practitioners to haphazardly install variable message signs around the nation without being accountable of any consequences.

127.Lovison, Douglas I. 1993. Promotional display signage and method of manufacture. Patent 5223357. Signs & Glassworks, Inc. U.S. Classification 430/1; 430/2; 359/1; 40546; 40615; 15624422; 156/272.6.

- i. Abstract:
- ii. A decorative promotional display signage and its method of manufacture includes the steps for combining the constituent elements of the signage, and the resultant combination of these elements. The signage includes a clear transparent substrate with an informational image created on the posterior surface of the substrate by selectively depositing transparent colored inks on this surface. Clear ink may also be deposited on selected portions of the posterior surface of the substrate to emphasize the informational image. A sheet of holographic film, to present a variable color cast to the image, is adhered to the substrate with the layers of ink positioned between the substrate and the holographic film.

128.Lucas, A. and Montoro, L. 2004. Some critical remarks on a new traffic system: VMS part II. In: the human factors of transport signs. CRC Press LLC: 199-212.

- i. Abstract:
- ii. Information technologies are aiding the growth of new and more rational road transport systems. At the core of Intelligent Transport Systems (ITS), traffic management and control critically depend on technical devices and road information well suited for road users because, in the end, the information in front of road users (e.g. VMS) is the basic tool for improving road traffic. In addition to a necessary technological optimism, a critical view is necessary for lessening or avoiding pitfalls. New presentation systems may distort the road sign system and worsen communication to road users. Official and unofficial road signs are currently undergoing promising research and professional and policy inquiries, hopefully to aid mobility and road safety. It is clear, though, that ITS may promote a heterogeneous, uncontrolled extension of the road sign system, thus making interpretation on the part of road users more difficult. In addition to changing road information elements (e.g., pictograms, abbreviations, and verbal labels), new VMS device structures force the use of different message formats, making road sign harmonization and coherence all the more difficult.

129.Lury, C. 2004. *Brands: The Logos of the Global Economy*. Abingdon: Taylor & Francis.

- i. This publication explores how brands: mediate the supply and demand of products and services in a global economy, frame the activities of the market by functioning as an interface, communicate interactively, selectively promoting and inhibiting

communication between producers and consumers, and operate as a public currency while being legally protected as private property in law. The author reviews how the subject of branding should be explored when studying sociology, cultural studies, and consumption.

130. Macnab, M. 2008. *Decoding Design: Understanding and Using Symbols in Visual Communication: Discover the Hidden Meanings Inside Common Corporate Logos and Designs*. Cincinnati: HOW Books.

- i. This book focuses on the importance of understanding symbols in the visual environment. It uses examples of corporate logos and sign designs to cover the process of designing such methods of branding.

131. Mahar, L. *American Signs*. 2002. New York: The Monacelli Press, Inc.

- i. This book covers the graphic history of signs on Route 66 in the United States of America focusing on their form and meaning.

132. Mandelker, D. R. & Ewald, W. R. 1988. *Street Graphics and the Law*. Washington, D.C. and Chicago: American Planning Association Planners Press.

- i. This text proposes a concept and a system to achieve innovative communication forms through the design of effective and pleasant on-premise signs. The system focuses on the communication between on premise signs and people, more specifically those using automobile transportation. The ideas offered in this book consider not only proportioning the size, height, and the placement of street graphics relative to the particular driving circumstances which they are to be seen, but also insist on the importance of considering the character of individual communities when implementing signage. Furthermore, the authors give evidence to the lawful aspect of this system as it considers the ordinances behind signage in its evaluation.

133. Martinson, T. 1995. *Signs of the City: the Role of Outdoor Advertising in Municipal Planning*. S.I.: S.N.

- i. This publication discusses the subject of outdoor advertising from a city planning perspective focusing on billboards, signs, and signboards.

134. McLendon, C. B. & Blackistone, M. 1982. *Signage: Graphic Communications in the Built World*. New York: McGraw-Hill.

- i. This book investigates buildings and graphic design as they relate to signs and signboards in the United States.

135. Metaxatos, P. and Soot, S. 2001. Evaluation of the driver's ability to recall the message content of portable changeable message signs in highway work zones. *Journal of the Transportation Research Forum*, 40(1):129-141.

- i. Abstract:
- ii. This paper examines factors that affect the ability of drivers to recall Portable Changeable Message Sign (PCMS) messages in highway work zones. A Chi square analysis has found that the time of day, driver's age, type of vehicle, and familiarity with the site are relevant factors, and that drivers were more likely to recall messages that contain action rather than problem statements. A regression analysis revealed that drivers recalled the PCMS message components that they desired to see almost twice as often, and that drivers familiar with the construction site were almost twice as likely to observe an action statement.

136. Methodology for Creating Beneficial, Cost-effective Sign Code, Parts 1-3. 2004. Signline. Alexandria: International Sign Association.

- i. Abstract: This three-part Signline begins with an examination of the reasons why regulators must be increasingly cautious in the area of signage regulation, and will help explain why continuing with business as usual could wind up being a costly mistake. It makes the case as to why a governing body should pursue a detailed cost-benefit analysis prior to adoption of a sign code. Part 2 provides an in-depth look at the factors to be considered in writing the cost-benefit analysis, as well as direct the regulator to sources of information. Finally, part 3 includes case studies of the effects of sign regulation on specific businesses and, in turn, the costs and benefits for the local community.

137. Miller, S. 2003. *Neon Techniques*. Cincinnati: ST Media Group International Inc.

- i. This publication reviews the neon industry covering subjects such as materials used in constructing neon tubes, electrical equipment involved, and different types of signs including outdoor/indoor, signs, letter types, and sign-hanging methods.

138. Mitchell, L. 2005. *Vinyl Graphics How-To*. ST Publishing, Inc.

- i. This publication includes over 80 photos in a step by step explanation of vinyl graphics.

139. Mitchell, W. J. 2005. *Placing words: Symbols, space, and the city*. Cambridge: MIT Press.

- i. Description:
- ii. The meaning of a message, says William Mitchell, depends on the context of its reception. "Shouting 'fire' in a crowded theater produces a dramatically different effect from barking the same word to a squad of soldiers with guns," he observes. In *Placing Words*, Mitchell looks at the ways in which urban spaces and places provide settings for communication and at how they conduct complex flows of information through the twenty-first century city.

Cities participate in the production of meaning by providing places populated with objects for words to refer to. Inscriptions on these objects (labels, billboards, signage, newspapers, graffiti) provide another layer of meaning. And today, the flow of digital information—from one device to another in the urban scene—creates a digital network that also exists in physical space. *Placing Words* examines this emerging system of spaces, flows, and practices in a series of short essays—snapshots of the city in the twenty-first century.

140. Morris, M., Hinshaw, M. L., Mace, D. & Weinstein A. 2001. Context-Sensitive Signage Design. American Planning Association.

- i. Description:
- ii. Signs exist to communicate information, but in many communities the sign industry and planning profession currently do not have an effective means of communicating with one another. The core of any relationship between two interests is understanding each other's motivation. This publication covers issues such as planning for signs, on-premise signs and traffic safety, aesthetic context: designing for place, and the economic context of signs.

141. Moving the Bus Back into Traffic Safely - Signage and Lighting Configuration Phase I. The National Center for Transit Research (NCTR). University of South Florida. Transportation Research Board. Posted on February 5, 2008.

- i. Description:
- ii. The National Center for Transit Research (NCTR) at the University of South Florida has released a report that explores efforts designed to improve the safety and effectiveness of bus pull-out bays. Efforts examined include lighting and signage on the back of the bus, roadway signs, and Florida yield-to-bus statutes.

142. Nasar, J.L. 1987. Effect of sign complexity and coherence on the perceived quality of retail scenes. *Journal of the American Planning Association* 53(4): 499-509.

- i. This paper examines the effects of signscape complexity and coherence on the perceived visual quality of streetside commercial scenes through a series of three studies studying the responses of the subjects to nine simulated streetside scenes. The subjects included both merchants and consumers and the complexity of the signs was studied using a variety of signs with different sizes, shapes, and colors in the signs and letters. Coherence was investigated using different size and contrast in signs and letters. The results showed that both consumers and merchants claimed that reductions in size and contrast as enhanced coherence, that excitement varied

directly with complexity and inversely with coherence, and that pleasantness and calmness were highest for moderate complexity and high coherence. The author concludes with suggestions for a revised sign ordinance taking the results of the study in to consideration.

143. Neon Lighting. 2005. International Association of Electrical Inspectors.

- i. Abstract:
- ii. This comprehensive guide to most electric neon signs and outline lighting takes the reader from a brief history of neon lighting to a study of the parts and components involved. It examines the characteristics of neon electrical circuits, transformers and power supplies, explains the codes and standards that apply, explores design and installation techniques and practices, and provides troubleshooting guidelines.

144. Nsour, S.A. 1997. IVHS and the elderly driving. Traffic Congestion and Traffic Safety in the 21st Century: Challenges, Innovations, and Opportunities. Chicago, Illinois: 333-339.

- i. Abstract:
- ii. This study was conducted on two groups, 385 elderly people and 126 young people with the age of 65 as the dividing line. The purpose is to examine the driving tasks that elderly see as difficult and then explore the possibilities of using Intelligent Vehicle Highway Systems (IVHS) to solve some of the driving problems faced by the elderly. The study showed that the tasks of driving at night, driving on two-lane highways at night, driving in rainy weather at night, and reading changeable message signs are the top most difficult tasks for elderly as compared with young drivers. About 25% of the elderly surveyed view reading changeable message signs as either difficult or very difficult. The most frequent suggestions by the elderly on improvements to the highway were those related to making signs more visible/readable, increasing sign-exit distance, and increasing sign illumination and reflection. About 52% of suggestions by the elderly on vehicle instrumentation centered on making the instrumentation more visible. The percentage of elderly in favor of electronic navigation maps is roughly 62% compared to 85% of the young.

145. OAAA Digital Billboards DVD. Outdoor Advertising Association of America.

- i. This DVD includes a five-minute video designed to explain digital billboards to policy-makers and the public.

146. OAAA Vegetation DVD. Outdoor Advertising Association of America.

- i. This DVD concentrates on importance of billboard visibility. It offers solutions and advise related to maintaining vegetation surrounding billboards.

147. Oliphant, R., Claus, J., & Claus, K. 1971. *Psychological Considerations of Lettering for Identification*. Cincinnati: Signs of the Times Publishing Co.
- i. This publication covers some of the technical components of lettering and the way in which these factors interact with the subconscious perception of the viewer to affect the success of the sign as a communication device. This book is divided in two sections: the first addressing the nature of lettering and the second investigating the dissuaders or persuaders in signage.
148. *On-Premise Signs: Determination of Parallel Sign Legibility and Letter Heights*. 2006. Pennsylvania Transportation Institute, Pennsylvania State University. United States Sign Council.
- i. This research provides legibility values for signs parallel to a motorist's point of view which are inherently more difficult to read than perpendicular signs mounted directly in front of the motorist. This research team used a mathematical model to calculate letter heights necessary for adequate parallel sign legibility. The model can readily be applied to current USSC legibility standards and the USSC Legibility Index allowing letter heights suitable for perpendicular signs to form the basis for parallel sign letter heights in similar roadside conditions. This study also provides equations for calculation of parallel sign letter heights as well as letter height look-up tables for typical parallel sign scenarios.
149. *On-Premise Signs: The Impact of Zoning Regulation on Site Performance*. 2005. Pennsylvania State University. United States Sign Council.
- i. This research includes tabular and graphic documentation of the experience of 88 mass market retailers, representing over 68,000 retail sites in the United States. Data from first person interviews was collected and analyzed forming a straight line relationship between business performance and adequate on-premise sign size, height, location, color, and position.
150. *One- and Two- Family Study Guide, NEC*. 2005 and 2008. International Association of Electrical Inspectors.
- i. Abstract:
 - ii. To better enforce electrical safety, it is vital for all electricians to become expert in design and installation of electrical systems in new and existing one- and two-family dwellings. It is even more incumbent on inspectors to be fully prepared to diligently examine those installations for safety. The *One- and Two-Family Dwellings Study Guide* has been painstakingly updated to the 2008 *NEC*. Questions are formulated to be similar to test formats you are likely to find in the electrical inspector certification examinations.

151. O'Neill, M. J. 1991. Effects of Signage and Floor Plan Configuration on Wayfinding Accuracy. *Environment and Behavior* 23 (5).
- i. This study investigates the influence of floor plan complexity and several types of signage on wayfinding within a series of buildings on a university campus. The results show that as floor plan complexity increases, wayfinding performance decreases. However, it was graphic signage that produced the greatest rate of travel in all settings. Textual signage was the most effective in reducing wayfinding errors, such as wrong turns and backtracking. Overall, the addition of signage resulted in a 13% increase in rate of travel, a 50% decrease in wrong turns, and a 62% decrease in backtracking across the five settings. This investigation shows the significant contribution to wayfinding effective signage provides.
152. "Outdoor is...". Outdoor Advertising Association of America.
- i. This publication acts as a reference guide filled with statistics, resources, growth trends, media comparisons, media math formulas, revenue and latest research. This book shows how outdoor advertising can enhance other media campaigns and deliver immediate results.
153. Patty, R.C. & Vredenburg, H. L. 1970. *Education Needs for the Electrical Sign Industry*. Philadelphia: Rohm and Haas Company.
- i. This publication covers a study designed to identify and investigate the major issues in the electrical sign industry. The study was designed to determine: the magnitude of the industry's present and future needs for skilled labor; some ways the problems may be solved; the basis for initiating formal training programs; and the peculiar educational needs of new management in the electrical sign industry.
154. Patty, R.C. & Vredenburg, H. L. 1970. *Electric Signs Contribution to the Communications Spectrum*. Philadelphia: Rohm and Haas Company.
- i. This publication reviews a study on electric signs run by a research team from the Colorado State University in Fort Collins and sponsored and funded by the Rohm and Haas Company of Philadelphia. The objectives of the study were: to define the potential functions of electric signs as an integral part of an effective communications program; to determine the specific objectives for which electric signs are now being bought and used; to show how these objectives may be quantified into benchmarks that may be used to measure the effectiveness and economy of electric signs; to develop a number of case histories giving evidence of the success of electric signs in accomplishing objectives set up for them; and to develop a

number of techniques for measuring the ability of electric signs to attain objectives set forth for them.

155. Parentela, E. and Eskander, N. 2001. Effectiveness of changeable message signs (CMS) on Los Angeles freeways. Improving Transportation Systems Safety and Performance. 2001 Spring Conference and Exhibit, Institute of Transportation Engineers. Monterey, California.
- i. Abstract:
 - ii. A survey was conducted to evaluate the effectiveness of changeable message signs (CMS) along Southern California freeways in terms of driver's response to displayed messages. The survey participants are regular commuters who spend an average of less than one to three hours daily on the freeway and are familiar with the operation of CMS. The usefulness of CMS and its ability to convey clear, accurate and reliable messages are some of the questions included in the survey. The paper also addresses the drivers' perception on trip safety and travel time. The results indicate a general agreement that CMS are helpful and reliable. Yet, while most motorists pay attention to the displayed messages and follow the diversion messages such as a detour, 28 percent consider them to be a distraction and 17 percent do not want to see additional CMS.
156. Passenger Information Services: A Guidebook for Transit Systems. Transportation Research Board's Transit Cooperative Research Program (TCRP). Transportation research Board. Report TCRP #45. Posted on April 7, 1999.
- i. Description:
 - ii. TRB's Transit Cooperative Research Program (TCRP) Report 45: Passenger Information Services: A Guidebook for Transit Systems provides instructions for designing passenger information aids. The research focused on traditional media (e.g., schedules, maps, and signage) for presentation of information.
157. A Passion for Safety: The History of IAEEI. 2005. International Association of Electrical Inspectors.
- i. This publication includes personalities, safety campaigns, humor, timelines, historical moments, and little known facts about IAEEI.
158. Paulson, S. 2006. *Church Signs Across America*. Woodstock: The Overlook Press.
- i. The subject matter of this book is church signs from churches of every denomination across America. The author studies church signs, signs and signboard, religious quotations and maxims, church buildings, and church marketing through signage.
159. Plan Review Study Guide, NEC. 2005 and 2008. International Association of Electrical Inspectors.
- i. Abstract:

- ii. Plan review is a critical part of the electrical inspection process. All electrical plans for new or altered installations are reviewed and approved before the installation or alteration is started. To enforce this necessary procedure, it is important for all electricians and inspectors to become proficient in plan review. The Plan Review Study Guide has been updated to the *NEC-2008*, and the questions are formulated to help ensure readiness for certification examinations.

160. Planning and Urban Design Standards. 2006. American Planning Association. Hoboken: John Wiley & Sons.

- i. This publication includes sets of standards for several urban design elements such as structures, building types, transportation, utilities, and signage.

161. Planning for Out of Home Media. 2001. Outdoor Advertising Association of America.

- i. This publication incorporates all of the dramatic changes that have taken place in advertising's mediums since its last edition five years ago. It includes update on the industry's continuing effort to provide viable & creative guidelines; successful out of home campaigns; travel trends & international out of home advancement.

162. The Procedure Handbook of Arc Welding. 200. The James F. Lincoln Arc Welding Foundation.

- i. Description:
- ii. This book contains over 750 pages of welding information techniques and procedures; photographs, drawings and charts.

163. Proffitt, D.R., Wade, M.M., and Lynn, C. 1998. Creating effective variable message signs: human factors issues. Virginia Department of Transportation, VTRC 98-CR31, Final Contract Report; Project No. 9816-040-940.

- i. Abstract
- ii. This report addresses the human factors issues related to the reading and comprehension of variable message sign (VMS) messages. A review of the literature was conducted on factors that affect how people read VMSs. Several topics were reviewed. The first topic was literacy. Since reading literacy is not a requirement for obtaining a driver's license, VMS composition should reflect the varied reading competence levels of motorists. It was found that about 25% of Virginians over the age of 16 are weak readers and will likely encounter problems reading VMSs. The second topic addressed how people read. Reading is an interactive process that derives much of its speed and accuracy from implicit knowledge acquired through familiarity. This implies that VMS messages should present familiar, standardized content whenever possible. A review of the literature on warning signs was the third topic. This review found that effective warning signs should have several properties:

short, concise messages are both easier to read and more likely to be read; and signal words, such as CAUTION, are not effective. Finally, areas for further research were identified. Symbolic messages and abbreviations are worthy of further investigation as they have the potential for easy recognition, provided they are familiar to motorists and can be accommodated by the VMS. In addition, although the Manual on Uniform Traffic Control Devices (MUTCD) advises angling the VMS away from the roadway to reduce headlight glare, angling the VMS toward the roadway could be desirable for increasing readability. In both these areas, theoretical and practical work is needed. The report recommends that these human factors characteristics and limitations be taken into consideration in the deployment of VMSs and in the composition of their messages.

164. Real World On-Premise Sign Visibility: The Impact of the Driving Task on Sign Detection and Legibility. 2002. Pennsylvania Transportation Institute, Pennsylvania State University. United States

- i. This research provides results of real world driving tasks and conditions impacting on-premise sign detection and legibility. The authors also compare real world and test track results to identify significant differences.

165. Reflections: The Art, the Smart, the Heart of America, as Seen Outdoors. 1999. Outdoor Advertising Association of America.

- i. This book was published as a commemorative piece for the last OAAA convention of the millennium. It acts as both a sales piece as well as a legislative tool for outdoor advertising.

166. Reicherter, B. 2005. The Channel Letter Sign Handbook. ST Publications.

- i. Description:
- ii. This new book by a veteran channel-letter sign maker can help anyone get started in design, construction and sales of channel-letter signs. It starts with the basics of channel letters, including how they are illuminated and mounted. Other chapters cover pricing and selling, choosing a reputable vendor, ordering channel letters from the manufacturer, and assembly. Photos illustrate the process of attaching a face to, and illuminating, a channel letter. Reverse channel letter design, fabrication and mounting are covered as well.

167. Safety and Human Factors: Design Considerations for On-Premise Commercial Signs. 1998. The Signage Foundation for Communication Excellence, Inc. and the International Sign Association.

- i. Abstract:
- ii. Dispelling the notion that easily identifiable and well-lit signage are deterrents to traffic safety, this book provides statistical evidence proving signs or stimuli do not

endanger motorists, but instead help them. This publication covers visibility of signs. It also considers how a sign's location, viewing angle, weather, and viewer vision and age affect sign visibility and asserts signs need to have adequate size and lighting, placement, or a combination of these to work effectively in communities.

168. Schiess, C. 1994. *The Light Artist Anthology: Neon and Related Media*. ST Media Group International Inc.

- i. This book captures the cutting edge of light as art in photographs of neon applications including signage along with interviews of 15 leading artists from Europe and North America.

169. Schwab, R.N. 1997. *Safety & Human Factors*. Alexandria: International Sign Association.

- i. Abstract:
- ii. This paper offers an analysis of the available literature on the correlation between signage deficiency and traffic accidents, and provides information on the viewer's ability to "make use" of the sign. Also included, is professionally based data concerning sign "properties," e.g. size, graphics, lighting, and placement. The information, for the most, specifically applies to on-premise business signs.

170. Schwartzman, A. 1998. *Designage: Art of the Decorative Sign*. San Francisco: Chronicle Books.

- i. Designage is a collection of over 300 photographs of storefront and other decorative signs taken in twenty three countries around the world. The chapters of the compilation of photographs are organized by the material used to make the signs - metal, tile, glass, neon, wood, brick, etc.

171. Sendich, E. 2006. *Planning and Urban Design Standards*. Hoboken: John Wiley & Sons.

- i. This publication covers the several topics of planning including , environmental management, building types, place-making, signage, and projection and demand analysis.

172. Shohamy, E. & Gorter, D. 2009. *Linguistic landscape : Expanding the Scenery*. New York: Routledge.

- i. The book investigates applied linguistic theories including the prolegomena to a sociolinguistic theory of public signage and how signage applies to linguistic landscapes.

173. Sign Design Gallery 2 &3. *Signs of the Times*. International Sign Association. Listed by U.S. Small Business Administration.

- i. These publications include more than 300 full-color photos from Signs of the Times Contest Winners in addition to more than 300 photos showcasing first-class sign

design and usage: ground signs, sign systems, projecting signs, wall-mounted signs, post-mounted signs, specialty signs, and entry monuments.

174. Sign Gallery International. Editors of Signs of the Times. International Sign Association. Listed by U.S. Small Business Administration.

- i. This publication includes more than 400 full-color photos of signage that identifies businesses, directs traffic, and informs the public from all over the world.

175. Sign Legibility, Overview and Calculation Methodology, Sign Legibility Index. 1998. United States Sign Council.

- i. This research through field observation provided the data for a Tabular Legibility Index of letter font, color, and contrast variations. The calculation methodology for sign size based on Legibility Index, traffic speed, negative space was also determined.

176. Sign Legibility, The Impact of Color and Illumination. 1998. Pennsylvania Transportation Institute, Pennsylvania State University. United States Sign Council.

- i. This report provides the results of test track studies on detection and legibility of on-premise signs. The findings provided a basis for the USSC Legibility Index.

177. Sign Visibility: Effects of Traffic Characteristics and Mounting Height. 2003. Pennsylvania Transportation Institute, Pennsylvania State University. United States Sign Council.

- i. This study uses computer simulation and mathematical models, to identify the significant sight line blocking of low mounted ground signs. The results include charts which illustrate the degree of sight line blockage in varied traffic flow scenarios.

178. Sign Visibility: Research and Traffic Safety Overview. 1996. Pennsylvania Transportation Institute, Pennsylvania State University. United States Sign Council.

- i. This research provides an overview of the basic safety factors affecting on-premise signs including a compendium of research data from all sources to date on the issue.

179. Signs in Vancouver. 1974. City of Vancouver Planning Dept. & Major Sign Industries under Direction of City Council's Standing Committee on Waterfront and the Environment.

- i. This document includes contemporary examples of good signage, graphics, and lettering. It intends to encourage a high standard for all signs.

180. Signs Showcasing Your Business. 2001. U.S. Small Business Administration.

- i. Description:
- ii. This publication was prepared for the U.S. Small Business Administration. Using graphics and photos to enhance the text, this booklet explains the value of signs in a highly competitive environment, serving as a valuable marketing aid for any sign

company. It can also be used to educate staff about the important role signs play in our lives.

181. The Signage Sourcebook: A Signage Handbook. 2003. Sherwood United States. Small Business Administration, Signage Foundation for Communication Excellence.

- i. This publication covers the subjects of the science of signage, valuation and evaluation of signs, legal considerations in sign regulation, and public policy considerations in sign regulation. This sourcebook is a result of the work of several groups including the U.S. Small Business Administration, the Signage Foundation for Communication Excellence, Inc., the University of Nevada at Las Vegas College of Business, the Nevada Small Business Development Centers, and the International Sign Association.

182. Signline #30-51. 2001-2007. International Sign Association.

- i. Description:
- ii. Signline is a newsletter for sign users, sign companies, planners, building and zoning officials, and other government groups connected with the sign industry. Presenting information on design review, amortization, the economic value of on-premise signs, and other related topics, this publication is a critical read for anyone dealing with signs.

183. Sims, M. 1991. *Sign Design: Graphics, Materials, and Techniques*. London: Thames and Hudson.

- i. This publication centers on the design and construction of signage.

184. Smiley, A., Persaud, B., Bahar, G., Mollett, C., Lyon, C., and Smahel, T. 2005. Traffic safety evaluation of video advertising signs. Presented at the Transportation Research Board's Annual Meeting, Washington, D.C.

- i. Abstract:
- ii. Road authorities are under increasing pressure from advertisers to allow video advertising in the right of way, but are understandably concerned about whether or not video signs constitute a driving hazard. At the City of Toronto's request, a comprehensive assessment of traffic safety impacts related to such signs was carried out in a series of studies involving three downtown intersections and an urban expressway site. An on-road eye fixation study was carried out to determine if drivers look at video advertising signs. Conflict studies were conducted to determine if there were more conflicts on video-visible than video-not-visible intersection approaches. A before-and-after sign installation study of headways and speeds on the urban expressway was carried out. Crashes, before and after sign installation, at the expressway and three intersection sites, were compared. Finally, a public survey

was conducted to determine if video advertising was perceived to impact traffic safety. Based on the eye fixation study and the public survey data, it is apparent that video advertising can distract drivers inappropriately, leading to individual crashes. However, the evidence from other studies was not consistent, suggesting that for the particular signs studied, overall impacts on traffic safety are likely to be small. Further studies, especially prospective ones with larger crash data sets are required to be certain. A comparison between this study and an earlier one suggests there are large differences in driver distraction dependent on the placement and environment in which the sign is seen. Further studies are required to determine factors, which minimize driver distraction.

185. Smiley, A., Smahel, T., and Eizenman, M. 2004. The impact of video advertising on driver fixation patterns. Presented at the Transportation Research Board's Annual Meeting, Washington, D.C.

- i. Abstract:
- ii. In order to assess driver distraction due to video advertising signs, eye fixation data were collected from subjects who passed 4 video advertising signs, 3 at downtown intersections and 1 on an urban expressway. On average drivers looked at the signs 45% of the time they were present. When drivers looked, they made 1.9 glances on average, with an average duration of 0.48 seconds. The distribution of eye fixations on intersection approaches where video signs were visible was compared to that on approaches on which video signs were not visible. There were no significant differences in the number of glances made at traffic signals or street signs. On the video approach there was a trend towards a greater proportion of glances at the speedometer and rear-view mirrors. Glances were made at short headways (1 second) and in unsafe circumstances (while crossing an intersection). In the downtown area, glances at static commercial signs were made at larger angles and at shorter headways than was the case for video signs. A comparison of our results with other studies showed that video signs were less likely to be looked at than traffic signs (about half the time versus virtually every time), that individual average glance durations and total durations were similar to those found for traffic signs. However, another on-road study indicates that some video signs can be very distracting. A video sign on a curve that was directly in the line of sight and visible for an extensive period attracted glances per exposed subject.

186. Smith, K. H. 1998. Gold Leaf Techniques. ST Publications.

- i. Description:

- ii. The guidebook provides updated information on materials, techniques and a full-color gallery of gold leaf signs. This book details the art of gilding with step-by-step instructions and more than 170 illustrations, covering both the basics of handling gold leaf as well as advanced techniques and applications. It explains the basic procedures for creating gold leaf window signs -- from layout, pounce patterns and gilding, to backing up, finishing and varnishing. Additional chapters show how to gild carved and sandblasted wood, glue-chipped glass, vinyl and more. Antique effects, common gilding problems, their causes, prevention and solutions are also included.

187. Soares Book on Grounding, 9E, NEC. 2005. International Association of Electrical Inspectors.

- i. Abstract:
- ii. Always controversial and mysterious, grounding has puzzled experts and caused non-experts to quake. IAEI has brought grounding down to earth in this updated book; and through the use of examples and detailed illustrations, the theory of grounding and bonding are set forth clearly, allowing you to quickly and easily master the subject. Step-by-step instructions for reducing hazards through design and installation of grounding in electrical distribution systems are given. Also covered are requirements for information technology equipment, limited energy and voice/data/video (VDV), neon signs and outline lighting, and other systems. Tables, charts, and formulas provide information on grounding electrode conductors and more.

188. Soares Book on Grounding. 2008. International Association of Electrical Inspectors.

- i. Abstract:
- ii. The work accomplished by the NEC Grounding and Bonding Task Group resulted in language that is more prescriptive and a streamlined approach to application and terminology. Another revision relates to the technical requirements for concrete-encased electrodes, where a vertically positioned concrete-encased electrode can be considered. The grounding and bonding requirements for second buildings or structures supplied from another building by feeders and branch-circuits have been revised. An intersystem bonding termination means that includes provisions for connecting at least three grounding or bonding conductors required for communications systems by chapter 8 is required. Grounding and bonding requirements for permanently installed generators are clarified. In accordance with IAEI's hallmark of systematic explanations, detailed illustrations and photos of actual installations enhance each topic. Seldom do design, engineering, installation

and enforcement perspectives come together in one book, especially on the controversial topics of grounding and bonding. This, however, is exactly what IAEI has achieved with this edition of Soares Book on Grounding and Bonding.

189.Soot, S. and Metaxatos, P. 1999. Policies for use of changeable message signs in highway work zones Illinois Transportation Research Center Final Report, Report No. ITRC FR 97-1.

- i. Abstract:
- ii. Portable Changeable Message Sign (PCMS) systems used in work zones are programmable supplementary traffic control devices that display messages composed of letters, symbols or both and provide information and instructions to the traveling public approaching work zone activities. The study seeks to develop warrants and criteria for PCMS deployment in Illinois highway work zones. It is recommended that PCMS systems be used during long- and intermediate-term stationary work, for traffic control through incident areas, and in projects where advance-time notification is needed. The discussion focuses on spacing criteria, number of signs required, sign visibility and message legibility, text alignment, distance criteria, message length, duration and type, project-level operational guidelines, message storage and dissemination, repair, maintenance and utility costs, as well as control and coordination issues. The study concludes that additional research is needed in order to: develop a comprehensive standardized statewide database of messages and message abbreviations; develop a comprehensive repository with information about the technology of the various components of the PCMS units; coordinate PCMS units used in highway work zones with a corridor or regional ATMS system; and maintain information about the use of a PCMS unit in a work zone project and possibly integrate it with other relevant information in a management system.

190.Sowell, T. T., Sowell, B. B. & Blasch, G. 1991. Remote Infrared Signage Evaluation for Transit Stations and Intersections. *Journal of Rehabilitation Research and Development* 6(4) 341.

- i. This article focuses on the need for alternative methods of developing signage beyond printed signs for the print disabled, visually impaired, or totally blind population. Sowell et al identify and discuss two of the most challenging problems faced by this subpopulation of travelers including negotiating complex transit stations and controlled intersections. The result of this investigation showed that blind people can quickly and easily learn to use remote infrared signage, such as Talking Signs, effectively and that its use improves travel safety, efficiency, and independence. Understanding signage is vital for successful travel. Furthermore,

considering different signage media may expand the consumer response to business-oriented signs as well as offer innovative ways for the industry to convey messages.

191.Sprengnagel, D. 1996. Neon World. ST Media Group International Inc.

- i. This publication features more than 350 full-color photos of neon signs, graphics, and artwork from major world cities as well as classics from Route 66 and the American Southwest.

192.Stabler, B. & Williams, D. 2001. Billboards in Akron, Ohio: A Concerned Investigation. Akron: University of Akron Department of Geography and Planning.

- i. The purpose of this paper is to determine if there is a spatial and socioeconomic pattern to billboards in Akron, Ohio.

193.Starr, T & Hayman, E. 1998. Signs and Wonders. New York: Doubleday.

- i. This book covers the history of signage in the United States and how the evolution of signs in production and form express a company's expression of its place in history in several aspects including design, financial, social, and technological.

194.Stern, R. 1996. The New Let There Be Neon. ST Publications.

- i. Description:
- ii. Since its development at the turn of the century neon has become an integral part of our urban experience, and the very visual definition of urban centers. Now in paperback at a new, lower price, this favorite explores the "light of the American dream" in all its raucous glory. This is the only book in which neon is studied as both handcraft and artistic medium with its own expressive potential.

195.Strattman, W. 2003. Neon Techniques. ST Books.

- i. Description:
- ii. This is the newest edition of the best-selling comprehensive guide to neon sign and cold cathode lighting. Recently updated by a Neon Techniques columnist, this book explains step-by-step the how-to of luminous tube design, manufacture and installation of signs, graphics and other applications. The guide covers the newest materials and equipment available, designing the sign, glass bending, pumping systems, bombarding, filling, testing and aging, flashers and time switches, installation, maintenance and much more. All photos, charts and graphs have been updated to reflect technological advances in the industry. A must for every neon shop.

196.Streetscape Equipment Sourcebook. 1976. Center for Design Planning. Chicago: American Public Works Association.

- i. This publication covers a variety of design planning topics including lighting traffic control, paving, and signage.
197. Structural Welding Guide for Sign Contractors & Installers. 2005. International Sign Association.
- i. Description:
 - ii. This guide, a new publication from ISA, introduces readers to the American Welding Society (AWS) Structural Welding Code for steel as a manual to provide a tool to help sign fabricators and installers develop welding procedures that support quality assurance. It presents a detailed description of two principal welding code requirements: qualification of a welding procedure specification (WPS) and welder performance qualification (WPQ).
198. Sutherland, M. 1989. Lettering for Architects and Designers: First and Second Editions. New York: Van Nostrand Reinhold.
- i. This book presents a range of lettering styles acceptable to the profession and includes some of the graphic potential of letters on presentation sheets and title blocks.
199. Sutton, J. 1965. *Signs in Action*. New York: Reinhold Publishing Corporation.
- i. This book includes a collection of different types of sign designs found all over the United States.
200. Tantala, M.W. and P.J. Tantala. 2005. An examination of the relationship between advertising signs and traffic safety. Presented at the Transportation Research Board's Annual Meeting, Washington, D.C.
- i. Abstract:
 - ii. The purpose of this study is to examine the relationship between advertising signs and traffic safety. The first part of this study establishes statistical correlation coefficients between advertising signs and accidents along the New Jersey Turnpike (for more than four years of data and about 23,000 accidents). This study considers various situations, with and without bias from turnpike interchanges. The results are analyzed for a variety of commonly accepted scenarios relating accident density to sign-density (the number of signs), to Viewer Reaction Distance (how far from a sign the driver is potentially within the "influence" of a sign), and to sign proximity (how far the accident is from the nearest sign). The second part of this study examines the incidence of traffic accidents at a specific, recently installed sign and for a period of time both before and after the installation of the sign. After the installation of a specific, advertising sign at a Pennsylvania intersection, the traffic volume increased, the APV (accident rate) decreased, the maximum number of

accidents in any given day or week decreased. The results of this study conclude that advertising signs have no significant statistical influence on the occurrence of accidents. These analyses also suggest that no causal relationship between advertising signs and accidents exists. Geospatial and geostatistical methods are used rigorously.

201. Taylor, C. R. 2005. *On-premise Signs as Storefront Marketing Devices and Systems*. Washington, D.C.: U.S. Small Business Administration.

- i. This book places emphasis on the value of on-premise signs as marketing devices. The author explains how on-premise signs play a critical role in identifying the place of business, branding the site, serving as an integral part of integrated marketing communications and/or enhancing store image.

202. Taylor, C. R. 2005. How excessive restrictions on signage backfire. *Journal of Consumer Marketing* 22(6): 304-305.

- i. The focus of this paper is to investigate the impacts of efforts by some municipalities to place various restrictions on on-premise signs and to examine the impact of strict regulation on local communities. The methodology involved included implementing examples of restrictive sign code and review articles providing empirical evidence on public perceptions of signs as well as the impact of signs on business and communities. The findings of this research show that excessive regulation of signs is counterproductive. Signage is shown to contribute to a community's economic vitality as well as described as helpful to consumers and business as well.

203. Traffic control, signals and other devices: highway safety, road user characteristics, traffic control and operations. 1976. National Research Council (U.S.) Transportation Research Board. Washington: National Academy of Sciences.

- i. This publication covers various aspects of traffic control concerning safety including devices such as signage.

204. Traffic Safety Study: An Examination of the Relationship between Signs and Traffic Safety. 2003. Tantara Associates, Consulting Engineers. United States Sign Council.

- i. Abstract:
- ii. This research examines the relationship between the presence of signs and traffic accidents through an intensive mile by mile analysis of the New Jersey Turnpike, one of the most highly traveled roads in the United States. Essentially, a thorough statistical analysis relating sign density to accident density concluded that roadside signs have no statistical relationship to the occurrence of accidents. An additional

study involving the relationship of accident data to the existence of an animated sign at a highly congested urban intersection indicated the same uncorrelated relationship between the existence of the sign and accidents rates over a two year period.

205.Trulove, J.G. 2000. *This Way: Signage Design for Public Spaces*. Gloucester: Rockport.

- i. Description:
- ii. As the pace of daily life continues to increase, it becomes more important for signs and graphics to communicate quickly, cleanly, and efficiently. This Way features today's best designs that achieve their utilitarian goals while managing to add interest and elements of attraction to their surrounding communities. Including striking examples of wayfinding, retail, health center, trade exhibit, theater, museum, public space, and other sign and graphic design setting, This Way showcases the latest and most effective designs in graphic systems for navigation and identification, and is an essential, up-to-date guide for those working in the field of architecture, graphic design and landscape architecture.

206.Tyke, C. R. 1982. Signage system and method of making same. Patent number: 4344244. U.S.

Classification 40611; 40616; 40491; 40490.

- i. Abstract:
- ii. A signage system includes a frame including a vertical support plate having horizontal sign mounting flanges on at least one side of the plate. Removable plate-shaped lettering inserts are mounted on the frame by mounting flanges on the back surface of the lettering inserts that mate with the mounting flanges on the support plate. The flanges are engaged by fitting the mounting flanges of the lettering insert endwise on the ends of the mounting flanges for the support plate and sliding the lettering inserts horizontally onto the frame. Removable end caps cover the ends of the frame and lettering inserts, with the end caps including at least two opposed resilient fingers that fit over and press resiliently against the opposite sides of the support plate to hold the end caps on the frame. The end caps are formed by joining together two identical halves.

207.Uebele, A. 2007. *Signage Systems & Information Graphics: a Professional Sourcebook*. New York: Thames & Hudson.

- i. Description:
- ii. This publication includes ideas on how to create the best, most effective graphics and signs. A signage system is much more than just a set of signposts and symbols. As well as its practical application, it helps to create an identity for a space and can add decorative flair to any built environment. Here, Andreas Uebele describes the

basic rules of signage design--and then goes on to show how to effectively break them. Signs must be visible but not distracting, informative but not unwieldy, and concise but not confusing. Color, typography, pictograms, and icons are all elements that can be varied and exploited to encapsulate as much information as possible and fit the job's requirements: the signage for a hospital, an airport, or a conference center may have little in common, and solutions must always be tailored to fit the location. The book showcases great examples of signage design worldwide, ranging from museums and schools to transport systems, with an emphasis on the most original approaches. It is not only an indispensable handbook for communications designers but also a must for architects, interior designers, and graphic artists who need a better understanding of this essential aspect of modern design.

208. Ullman, G.L., Ullman, B.R., Dudek, C.L., and Trout, N.D. 2004. Legibility distances of smaller character light-emitting diode (LED) dynamic message signs for arterial roadways. City of Dallas Transportation Management Systems Final Report.

- i. Abstract:
- ii. This report documents the results of a legibility study of 9-in. and 10.6-in. characters on dynamic message signs (DMSs) for use on arterial roadways. The study, conducted at Dallas, Texas, consisted of 60 Dallas residents (demographically balanced with respect to age and education) who drove a test vehicle as they approached DMSs with one of the above two character heights. Study administrators recorded the distance from the sign at which the participant could correctly read a three-character word. Data were recorded for three trials on each of the two character heights for each participant. Data were collected during daylight (sun overhead) and nighttime conditions. The 85th percentile legibility distances for each character height were used to estimate available viewing times under various approach speeds. These available viewing times dictate the units of information that can then be presented on a DMS of a particular character size. Based on the results of the analysis, researchers recommend that the City of Dallas continue to utilize 12-in. characters for DMSs on their arterial roadways. Even then, the amount of information that is presented on the DMS should be limited to 3 units of information or less under nighttime viewing conditions. Agencies should consult other references, as documented within this report, regarding proper message design principles, appropriate abbreviations to use, etc., prior to designing and implementing an arterial street DMS system.

209.USDOT. 2003. Manual on Uniform Traffic Control Devices. U.S. DOT, Federal Highway Administration. Available at: <<http://mutcd.fhwa.dot.gov/>>.

- i. Abstract:
- ii. The Manual on Uniform Traffic Control Devices (MUTCD) defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways. The MUTCD is incorporated by reference in 23 Code of Federal Regulations (CFR), Part 655, Subpart F. Although the MUTCD is routinely updated to include amendments that clarify new standards and incorporate technical advances, it has been more than 20 years since the manual was entirely rewritten, and the most recent edition was published in 1988. The new MUTCD is published in 3-ring binders for easy updating, on CD-ROM, and on the Internet. Redesigned text format will help users identify STANDARDS -- "shall" conditions; GUIDANCE -- "should" conditions; OPTIONS -- "may" conditions; and SUPPORT -- descriptive and/or general information for designing, placing, and applying traffic control devices. Measurements are presented in both metric and English units.

210.United States Bureau of Reclamation. 2002. *Sign Guidelines: For Planning, Design, Fabrication, Procurement, Installation, and Maintenance of Signs for Outdoor Public Use Areas*. Washington, D.C.: U.S. Dept. of the Interior, Bureau of Reclamation.

- i. Abstract:
- ii. Effective communication with the public requires the clear, concise delivery of an understandable message through a certain medium. One of the best ways to convey information to the public is through the medium of signs. A comprehensive sign program should foster safety, facilitate management of an area, provide a learning opportunity for visitors, and offer a positive image and identity for all entities involved in the management of the area (i.e., Bureau of Reclamation [Reclamation], water districts, State parks, etc). There has been a lack of conformity or continuity in signing of projects administered by Reclamation. Establishing uniform sign guidelines will aid in maintaining a positive Reclamation identity. The intent of this document is to provide needed direction that will facilitate uniform application of the signing guidelines on a Reclamation-wide basis. The guidelines contained herein are, for the most part, discretionary and may be used by Reclamation and others. However, if signs are to be installed on Reclamation lands, they must comply with certain accessibility laws and regulations and comply with the common elements of the Bureau of Reclamation's Visual Identity Program. In addition, the Federal

Highway Administration's *Manual on Uniform Traffic Control Devices* must be followed when placing these types of signs on Reclamation lands.

211. United States Sign Council Best Practices Guideline Standards For On-Premise Signs. 2003. United States Sign Council.

- i. This document presents research based approaches to sign size, legibility, and height. It is illustrated with tables, charts, and mathematical formulae designed to facilitate the calculation of sign letter height and copy area, negative space, overall sign size, and sign height as functions of the speed of travel utilizing the application of such factors as message size, message scan time, viewer reaction time and distance, and copy area. This information is presented in an easy to understand method using simple tables or equations.

212. Van Houten, R. and Malenfant, J.E.L. 2002. Evaluation of changeable message signs (CMS) on I-4 at exits 30a and 30b to assign ramp traffic and at Princeton St. to sign for cultural events. Florida Department of Transportation Final Report.

- i. Abstract:
- ii. Florida Department of Transportation performed an experimental analysis of a series of changeable message signs functioning as freeway guide signs to assign traffic to Universal Theme Park via one of two eastbound exits based on traffic congestion at the first of the two exits. An examination of crashes along the entire route indicated a statistically significant increase in crashes at the first eastbound exit following the actuation of the system. Behavioral analysis scored from videotapes of driver behavior at the first eastbound exit, revealed that the reassignment of the theme park exit was associated with an increase in the percentage of motor vehicle conflicts such as the percentage of vehicles cutting across the exit gore and the percentage of motorists making unsafe lane changes in the immediate vicinity of the exit. A human factors analysis revealed that the method used for switching the designated or active theme park exit on the series of changeable message signs led to the presentation of conflicting messages to some motorists. The second experiment evaluated the use of a phased method of switching the designated theme park exit to eliminate the delivery of conflicting messages. The new method for switching the designated theme park exit was not associated with an increase in motorists cutting across the exit gore or unsafe lane changes. Based on the results obtained in the second experiment, it is recommended that the system used to assign the active exit based on traffic congestion be added to the *Manual on Uniform Traffic Control Devices* (MUTCD). A third experiment evaluated the use of changeable message

signs to provide information on cultural events in the Orlando area at a single exit (eastbound and westbound). These signs were not associated with an increase in crashes. It is also recommended that this use for changeable message signs be added to the MUTCD.

213. Vereen, S., Hummer, J E, Rasdorf, W. 2002. *A Sign Inventory Study to Assess and Control Liability and Cost*. North Carolina State University: North Carolina Department of Transportation.

- i. The main objective of this project was to determine, quantify, and present to the North Carolina Department of Transportation (NCDOT) alternative approaches for meeting the Federal Highway Administration's (FHWA) proposed minimum level of retroreflectivity for signs. This study used knowledge of the current NCDOT sign maintenance practices to synthesize a list of components and alternatives to comply with the standard. The fundamental contribution of the work lies in creating alternative methods to evaluating sign retro reflectivity to ensure compliance with a standard while minimizing the cost and labor required to do so. The four alternatives formulated were: (1) continue with current inspection method; (2) make improvements to current inspection method; (3) implement a sign inventory management system in addition to the current inspection method; and (4) a combination of the second and third alternatives. This report recommends that the fourth alternative be adopted by NCDOT, although it is the most expensive option. It was also recommended that an evaluation be made periodically to determine what benefits and improvement in sign condition, if any, have resulted from the alternative's implementation. This investigation contributes to the ongoing study of the materials used to produce signs as well as the techniques to maintain them.

214. Wallace, B. 2003a. Driver distraction by advertising: genuine risk or urban myth? Proceedings of the Institution of Civil Engineers, Municipal Engineer 156, Issue ME3:185 – 190.

- i. Abstract:
- ii. Drivers operate in an increasingly complex visual environment, and yet there has been little recent research on the effects this might have on driving ability and accident rates. This paper is based on research carried out for the Scottish Executive's Central Research Unit on the subject of external-to-vehicle driver distraction. A literature review/meta-analysis was carried out with a view to answering the following questions: is there a serious risk to safe driving caused by features in the external environment, and if there is, what can be done about it? Review of the existing literature suggests that, although the subject is under-

researched, there is evidence that in some cases over complex visual fields can distract drivers and that it is unlikely that existing guidelines and legislation adequately regulate this. Theoretical explanations for the phenomenon are offered and areas for future research highlighted.

215. Wallace, B. 2003b. External-to-vehicle driver distraction. Scottish Executive Central Research Unit Report.

- i. Abstract:
- ii. This report presents the findings of a literature review of all available literature published in English since 1945 on the subject of external-to-vehicle driver distraction. The report was carried out by Human Factors Analysts Ltd. (HFAL) on behalf of the Scottish Executive between December 2002 and March 2003. The research consisted of three main elements. First, a general review of the literature pertaining to driver distraction. Second, a review of literature specifically concentrating on external-to-vehicle distraction. And finally, a review of literature pertaining to billboards and signs as an external distracter, in an attempt to discover whether there is evidence that billboards and signs are a contributory factor to road accidents.

216. Walton, J.R., Barrett, M.L., and Crabtree, J.D. (2001). Management and effective use of changeable message signs. Kentucky Transportation Cabinet, KTC-01-14/SPR233-00 1F, Final Report.

- i. Abstract:
- ii. Changeable message signs (CMSs) are used to communicate accurate, timely, and pertinent information to travelers on Kentucky's roadways. This information helps travelers avoid hazards or delays and respond properly to changing roadway conditions. In an ideal environment, the Kentucky Transportation Cabinet (KYTC) would be able to allocate CMSs to various areas of the state based upon changing needs. The location of each sign would be monitored, and the message could be controlled and checked remotely. Currently these capabilities do not exist. KYTC has four different types of portable CMSs in use throughout the state. Each type has different internal and external interfaces, and each requires different replacement parts. Also, there is no policy or guidelines in place for the use of these signs. The decision on how and when the CMSs are used is made at the district level on a case-by-case basis. This research effort includes an evaluation of Kentucky's current inventory and usage of CMSs, identification of key issues associated with the signs, and identification of state and regional policies on the management and use of

CMSs. Recommended guidelines for the management and use of CMSs are included in this report.

217. Wachtel, J. 1981. Electronic advertising along highways--concern for traffic safety. *Public Roads*, 45(1): 1-5.

- i. Abstract:
- ii. Developments in electronics, computers, and communications are being applied to traffic signs. One of the most advanced developments is the lamp matrix system, which is one form of a commercial electronic variable message sign (CEVMS). Although a 1978 amendment to the Highway Beautification Act legitimized commercial signage using the latest technology, earlier federal laws still in force prohibited signs illuminated by flashing, intermittent, or moving light or signs that move or have animated or moving parts. The Federal Highway Administration through research and field observations demonstrated that CEVMS's have the potential for animation and for flashing, moving, and intermittent message presentation, and some operating signs already display these characteristics. In addition a correlation was established between roadside advertising and traffic accidents.

218. Wachtel, J. 1980. *Safety and environmental design considerations in the use of commercial electronic variable-message signage*. Washington: Dept. of Transportation, Federal Highway Administration, Office of Research, Environmental Division. Final Report: FHWA-RD-80-051.

- i. Abstract:
- ii. This study reviews existing reported research and experience regarding use of commercial electronic variable-message signs (CEVMS), and evaluates research findings and methods in terms of implications for highway safety and environmental design. Aspects of CEVMS design and use that are capable of adversely affecting highway safety and/or environmental quality are identified and discussed in terms of the adequacy of existing research and experience to permit formulation of quantified standards for safe and environmentally compatible use. This report notes, with illustrations, the principal forms of variable-message signage developed for official traffic control and informational use, and the major forms of variable-message signage utilizing electronic processes or remote control for display of commercial advertising and public service information in roadside sites. Studies of highway safety aspects of outdoor advertising, which are based on analysis of accident data, are evaluated and reasons for apparent conflicts of their findings are discussed. Studies of highway safety aspects of outdoor advertising generally and CEVMS

specifically based on human factors research and dealing with distraction and attentional demands of driving tasks are discussed in relation to issues involved in the development of standards.

219. Wener, R.E. & Kaminoff, R. 1982. Improving environmental information: effects of on perceived crowding and behavior. *Environment and Behavior* 14(6): 671-694.

- i. Abstract:
- ii. The study examined ways of modifying perceptions and use of a high density environment, without changing actual density levels. In particular, the effects of adding information cues were observed. Several signs identifying the location of activities and describing visitor registration procedures were installed in the crowded lobby of a federal correctional center, as the result of some findings from a post-occupancy evaluation. Attitudes and behaviors of visitors in the lobby were measured before and after installation of the signs. The behavior of visitors was observed from the moment they entered the lobby until all registration forms were completed. Visitors were asked to rate the lobby environment and the institution's staff on a number of seven-point scales. The presence of the signs significantly reduced perceived crowding, discomfort, anger, and confusion, as well as the amount of time needed to complete the registration process. The signs also tended to reduce the number of wrong turns, requests for information, and confused gestures by visitors. The study demonstrates the role cognition may play in altering the perception of crowding and ameliorating some of its negative consequences. Implications for cognitive models of crowding are discussed.

220. Wheeler, A. 2006. *Designing Brand Identity: A Complete Guide to Creating, Building and Maintaining Strong Brands*. Hoboken: John Wiley.

- i. This work approaches the challenge of branding for companies by translating the vision of a CEO and conducting research. It covers the steps involved in designing a sustainable identity program and building online branding tools. Implementing effective brand identity is important to businesses and tools such as signage can aid in the development and maintenance of such brands.

221. Williamson, D. L. 2008. Sign Law & Policy. *Sign Business*. October 52-53.

- i. David L. Williamson while practicing sign and business law in the state of Ohio is also a veteran of the sign and commercial graphics markets. This article offers a brief introduction of the implications of the adoption of form-based zoning on a city level. Williamson calls for careful attention to the positive effects form-based

codes may have for the sign industry in relation to creating sign standards including controlling the allowable sign sizes, materials, illumination, and placement.

222. Woodman, Michel A. G. et al. 1988. Sign and signage systems. Patent number: 4753026. Esselte Pendaflex Corporation. U.S. Classification 40/10R; 40618.

- i. Abstract:
- ii. A sign unit is described which may be used in a variety of ways to make up signs. The unit consists of an extruded section having a flat central web (1, 30) and two flanges (2, 3, 32, 33). The outer surface of web (1) remote from the flanges can have a legend printed on it. Alternatively a sign plate (14, 15, 37, 38) may be inserted between flanges (2 and 3) and held against e.g. ribs (4) or in grooves (35, 36). The flanges or formations thereon may be dimensioned to cooperate with a holder on which the unit may be clipped. The sign unit is preferably made of aluminium alloy or rigid plastics material.

223. Woodward, K. 2002. Sign Design and Layout. ST Publications, Inc.

- i. Description:
- ii. This book is a primary, practical approach to sign design. With 485 sample designs, it covers the basic principles of layout, lettering styles, reverse panels, borders and space fillers, logos, trademarks and more.

224. Wong, L. T. & Lo, K.C. 1995. Experimental Study on Visibility of Exit Signs in Buildings. *Journal of Illuminating Engineering Society* 24 (2): 64-72.

- i. This study investigated the visibility of exit signs in terms of the height of the sign in an 18 m internal corridor. The four variables included graphics, colors, lighting conditions and ages of the observers. The layout of the study combined designations containing the English and Chinese words EXIT, five directional indicators and two exit symbols in different colors under normal and emergency lighting conditions which were presented to 30 observers of different age groups to determine their visibility. The results included increased height for correct identification for an exit sign containing two symbols as compared to a sign containing only one symbol and a green exit sign was reported to be highly visible. It also reported that at reduced illumination, the sign height for correct identification increased. These findings focused on how the physical aspects of signs can contribute to the process of improving the construction of signs in respect to their visibility.

225. Yager, D., Aquilante, K., and Plass, R. 1998. High and low luminance letters, acuity reserve and font effects on reading speed. *Vision Research*:2527-2531.

- i. Abstract:
- ii. Compared reading speed in 46 normally sighted high school and optometry students with two fonts, Dutch (serif) and Swiss (sans serif). Text was displayed on a computer monitor, white letters on black, with the RSVP method. Luminance of the letters was either 146.0 or 0.146 cd/m². Lower-case x-height of the fonts was approximately 5.5 times as large as letter acuity. At the high luminance, there was no difference between reading rates. There was a significant advantage for the Swiss font at the low luminance. The acuity reserve for Swiss was higher than for Dutch at the low luminance, which may account for the difference in reading speeds.

226. Young, S. 2004. Visibility achieved by outdoor advertising. Perception Research Services Summary Report. Available at:

<http://www.prsresearch.com/articles/visibility_achieved_by_outdoor_ad.htm>.

- i. Abstract:
- ii. Perception Research Services of Fort Lee, NJ, implemented a pilot study of attention to outdoor advertising, as documented via the use of PRS ShopperVision eyeglasses, i.e., the recording of passengers' seeing experience while traveling in an automobile on a high speed interstate highway. Fifty licensed drivers were interviewed (25 men and 25 women). All were between the ages of 18 and 70, with one-third 18 to 34, one-third 35 to 49, and one-third 50 to 70. Each participant was in an automobile (wearing PRS ShopperVision eye glasses) for a 30-minute highway drive. The drive took place in northern New Jersey along Interstates 95 and 80. Twentyeight (28) boards were posted along these highways. 74 percent of boards in the rider's field of view were noted and 48 percent of the boards in the rider's field of view were read.

227. Zwahlen, H.T., Sunkara, M., and Schnell, T. 1995. Review of legibility relationships within the context of textual information presentation. Transportation Research Record, No. 1485: 61-70.

- i. Abstract:
- ii. An extended review of the relevant legibility literature was conducted to provide normalized legibility performance data for a comparison and consolidation of past legibility research. The data were normalized by expressing the legibility performance in terms of visual angle subtended by the character height. The data revealed large variations in visibility performance among the reviewed studies, despite similar or even identical experimental treatments.