

Digital Technology

- ❑ In 1996, the Federal Highway Administration (FHWA) said “changeable message signs are acceptable for off-premise signs, regardless of the type of technology used.”
- ❑ Digital technology is another method of changing billboard copy.
- ❑ Digital billboard messages are static; they do not scroll, flash or feature full-motion video.

Digital Billboards

Background

- Out of home advertising is a growing \$6.8 billion industry; the OAAA anticipates sustained growth in 2007.
- A tiny fraction of billboards are digital (500-plus out of an estimated 450,000 total billboards in the United States).
- Over the next few years, it is anticipated that several hundred digital displays may be built each year.
- Copy changes on billboards; digital technology is a means for changing static copy.
- Digital billboards display static messages that resemble standard painted/printed billboards when viewed.
- Digital billboards do not feature animation, flashing lights, scrolling, or full-motion video. These standards are reflected in the OAAA *Code of Industry Practices* to ensure that commercial and noncommercial messages disseminated on standard-size digital billboards will be static messages and the content shall not include animated, flashing, scrolling, intermittent or full-motion video elements.

Advantages of Digital Billboards

- Authorities can deliver emergency and law-enforcement information:
 - AMBER Alerts to find missing children
 - Weather and disaster bulletins
 - “Wanted” information to help police find fugitives
- Advertisers can deliver real-time information.
- Most advertisements on digital billboards promote local businesses, and most of those are considered “small businesses.”
- Digital billboards can adapt quickly in fast-changing, competitive environments. Examples include:
 - Changing interest rates or mortgage rates
 - Lottery jackpots
 - Sales specials

OAAA Digital Technology Brief

- There is the potential for advertisers to target and purchase by day part, location or geography.
- Advertisers no longer have printing and shipping costs.
- Multiple advertisers can share prime locations.
- Digital boards create demand for high-tech jobs.

Digital Billboard Regulations

- In 1996, the Federal Highway Administration (FHWA) issued a memo that said changeable-message billboards are acceptable if allowed by state-federal agreements. Most states allow changeable-message billboards.
- States determine “dwell time” (typically six or eight seconds) and spacing between billboards.

Traffic Safety

- The Virginia Tech Transportation Institute (VTTI) study released in early 2004 said that billboards do not significantly affect driver behavior. Lead researcher, Dr. Suzanne E. Lee, concluded that neither visual behavior nor driving behavior changes measurably, even in the presence of the most visually attention-getting billboards.
- FHWA says that tri-action billboards do not pose distraction problems. (*FHWA, commenting in the Federal Register regarding a change in the federal-state agreement with the State of Oregon, to allow tri-action billboards. Federal Register, Volume 67, No. 63, April 2, 2002/Notices*)
- The AAA Foundation for Traffic Safety has done extensive research on distraction. A major study based on crash data and prepared for the Foundation by researchers at the University of North Carolina said items such as CB radios, billboards, and temperature controls are not significant distractions. (*“The Role of Driver Distraction in Traffic Crashes,” Page 33, prepared by University of North Carolina Highway Safety Research Center, Chapel Hill, NC (2001)*)

References

OAAA Code of Industry Principles, April 2006

America's Most Wanted, news release, February 15, 2007

City of Albuquerque, Environmental Health Department, media alert, Alfredo Santistevan, Director, October 31, 2006

"Off-Premise Changeable Message Signs," memorandum to regional administrators, Barbara K. Orski, Director, Office of Real Estate Services, Federal Highway Administration, Washington, DC, July 17, 1996

State Changeable Message Chart (Source: OAAA)

Model state statutory and regulatory language (*OAAA Changeable Message Compendium of Laws, available as downloadable file from the OAAA website*)

Regulating Digital Billboards, OAAA Brochure, 2006

"Changeable Message Signs," policy guidance to district engineers, Michael M. Ryan, P.E, Deputy Secretary for Highway Administration, Pennsylvania Department of Transportation, Harrisburg, PA, April 24, 2002

OAAA Code of Industry Principles

In addition to adhering to external laws and regulations, the members of the Outdoor Advertising Association of America have adopted a set of voluntary industry principles. The OAAA endorses this Code and encourages its members to operate in conformance with these principles.

This portion of the *Code* addresses digital technology:

- **We are committed to ensuring that the commercial and noncommercial messages disseminated on standard-size digital billboards will be static messages and the content shall not include animated, flashing, scrolling, intermittent or full-motion video elements (outside established entertainment areas).**
- **We are committed to ensuring that the ambient light conditions associated with standard-size digital billboards are monitored by a light sensing device at all times and that display brightness will be appropriately adjusted as ambient light levels change.**



Cleveland, OH (February 15, 2007) – Making history in Cleveland, *America's Most Wanted* will use a new tool to track down fugitives: **digital billboards.**

“High-tech billboards are one of the latest ways to reach the public,” said John Walsh, host of *America's Most Wanted*. “Our goal is to empower the public to help law enforcement.”

Since 2000, the United States Marshals Service and their Northern Ohio Violent Fugitives Task Force have been looking for David “Daddy Dave” Green. He allegedly escaped from a prison in Elkton, OH, where he was serving a 19.5-year sentence.

Green ran a narcotics organization in Cleveland in the late 1980s and early 1990s, distributing millions worth of cocaine. A raid on Green's home in 1991 found high-powered rifles, automatic weapons, and drug paraphernalia.

America's Most Wanted, the long-running crime-fighting show on FOX-TV, aired a segment on the David Green case in August of 2006.

On February 15, *America's Most Wanted* will display information about this case on seven digital billboards in the Cleveland area. The "wanted" billboards will feature the suspect's photo, along with a toll-free number and website for anonymous tips from the public (1-800-CRIME-TV, www.amw.com). This alert will be issued as a public service by Clear Channel Outdoor, which operates the billboards.

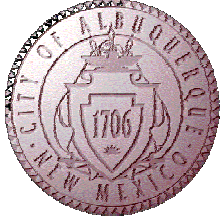
Digital technology is the latest way of changing the message on a billboard. A digital billboard displays a static message (for eight seconds in Ohio), and then a new message appears. The new digital billboards in Cleveland also are part of the AMBER Alert system.

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**City of Albuquerque
Environmental Health Department**



Martin J. Chávez, Mayor

Alfredo R. Santistevan, Director

October 31, 2006

To: Media Contacts

From: Alfredo Santistevan, Director Environmental Health Department
City of Albuquerque

Subject: Emergency Preparedness Planning Partnership with Clear Channel

Mayor Martin J. Chávez, and the City of Albuquerque Environmental Health Department are pleased to announce their commitment to Emergency Preparedness for the citizens of Albuquerque. In preparation of a National Disaster or any emergency that may affect our community; the City of Albuquerque had partnered with Clear Channel Outdoor to utilize their new technology- Digital Billboards to broadcast any type of emergency. This news conference will take place Wednesday, November 1st at 11:00am, at the Digital Billboard located at Edith and Lomas- near Embassy Suites on Lomas.

Additional MEDIA Contact Information:

*Nadine J. Martinez, Marketing Development Manager
Environmental Health Department, City of Albuquerque
505-768-2621 Office
505-239-5436 Cell*

1996 FHWA e Changeable Message Signs," memorandum to regional administrators, Barbara K. Orski, Director, Office of Real Estate Services, Federal Highway Administration, Washington, DC, July 17, 1996



U.S. Department
of Transportation
Federal Highway
Administration

Memorandum

Subject: INFORMATION: Off-Premise Changeable Message Signs

Date: JUL 17 1996

From: Director, Office of Real Estate Services

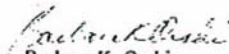
Reply to
Attn. of: HRE-20

To:
Regional Administrators

A number of States are taking the position that certain off-premise changeable message signs are consistent with State law and do not violate the lighting provisions of their State/Federal agreement. The State of Georgia recently amended its State law to allow off-premise signs having panels or slats that rotate provided they meet State criteria for frequency of message change and spacing. The State of Oklahoma recently considered amending its State law to also allow these signs. Because of the increased use of changeable message signs, we believe it is timely to restate our position concerning these signs.

The Federal Highway Administration (FHWA) has always applied the Federal law 23 U.S.C. 131 as it is interpreted and implemented under the Federal regulations and individual State/Federal agreements. Because there is considerable variation among the States, the importance of these agreements cannot be overstated. In the twenty-odd years since the agreements have been signed, there have been many technological changes in signs, including changes that were unforeseen at the time the agreements were executed. While most of the agreements have not changed, the changes in technology require the State and FHWA to interpret the agreements with those changes in mind. Changeable message signs are acceptable for off-premise signs, regardless of the type of technology used, if the interpretation of the State/Federal agreement allows such signs. In nearly all States, these signs may still not contain flashing, intermittent, or moving lights.

The FHWA will concur with a State that can reasonably interpret the State/Federal agreement to allow changeable message signs if such interpretation is consistent with State law. The frequency of message change and limitation in spacing for these signs should be determined by the State. This interpretation is limited to conforming signs, as applying updated technology to nonconforming signs would be considered a substantial change and inconsistent with 23 CFR 750.707(d)(5).


Barbara K. Orski

State Changeable Message Chart
 (Source: OAAA State Statute Matrix)

No changeable message signs allowed:

Tri- action Only

Changeable Message Including electronics

(4 STATES)
 DE, ND, NH, WY

(6 STATES)
 MD, MA, MS, OR,
 TX, WA,

(36 STATES)
 AL, AR, AZ, CA, CO, CT
 FL, GA, ID, IL, IA, IN, KS,
 KY, LA, MI, MN, MO, MT,
 NE, NV, NJ, NM, NY, NC,
 OH, OK, PA, RI, SC, SD,
 TN, UT, VA, WV, WI

OAAA Changeable Message Criteria
 Dwell Time Sequence – By State

<u>Dwell Time (Static Message)</u>	<u>State</u>
<u>4 seconds</u>	CA, CO, IA, NJ, VA
<u>5 seconds</u>	NM, PA
<u>6 seconds</u>	AL, AZ, CT, FL, GA, MI, MN, NV, NY, SD, WI, RI (average)
<u>8 seconds</u>	AR, ID, KS, LA, MO, NC, OH, OK, OR, SC, TN, UT, WV, WA
<u>10 seconds</u>	IL, IN (average), MS, NE, MD, TX
<u>Other/State-Company Discretion</u>	KY, MA, MT

Dwell and Twirl Times for message changes and spacing criteria

States Allowing Changeable Message Including Electronics

<u>State</u>	<u>Dwell time</u>	<u>Twirl time</u>	<u>Spacing</u> *traditional 500 ft
AL	6 seconds		
AR	8 seconds or more	2 seconds or less	*
AZ	6 seconds	1 second	*
CA	4 seconds	4 seconds	1000 feet
CO	4 seconds	1 second	1000 feet
CT	6 seconds	3 seconds	*
FL	6 seconds	2 seconds	1000 to 1500 feet
GA	10 seconds	2 seconds	5000 feet
ID	8 seconds	2 seconds	*
IL	10 seconds	3 seconds	*
IN	8-12 seconds	2-7 seconds	*
<i>Allowed only on state roads where permits are not required</i>			
IA	4 seconds	2 seconds	*
KS	8 seconds	2 seconds	1000 feet
KY	<i>At discretion of state DOT</i>		
LA	8 seconds	4 seconds	*
MI	6 seconds	1 second	*
MN	6 seconds	none	*
MS	10 seconds	3 seconds	*
MO	8 seconds	2 seconds	1400 feet
MT	<i>At discretion of state DOT</i>		

Dwell and Twirl Times for message changes and spacing criteria (cont'd)

States Allowing Changeable Message Including Electronics

<u>State</u>	<u>Dwell time</u>	<u>Twirl time</u>	<u>Spacing</u>
NE	10 seconds	2 seconds	5000 feet
NV	6 seconds	3 seconds	*
NJ	4 seconds	2 seconds	3000 feet
NM	5 seconds	1-2 seconds	*
<small>Company discretion</small>			
NY	6 seconds	3 seconds	*
NC	8 seconds	2 seconds	1000 feet
OH	8 seconds	3 seconds	1000 feet
OK	8 seconds	4 seconds	*
PA	5 seconds	1 second	*
RI	5-7 seconds	2-3 seconds	*
<small>Company discretion</small>			
SD	6 seconds	none	*
SC	8 seconds	2-3 seconds	*
TN	8 seconds	2-3 seconds	1000 feet
UT	8 seconds	3 seconds	*
VA	4 seconds	none	*
WV	8 seconds	2 seconds	1500 feet
WI	6 seconds	1 second	*

Dwell and Twirl Times for message changes and spacing criteria (cont'd)

States Allowing Changeable Message Including Electronics

Tri-action Only

<u>State</u>	<u>Dwell time</u>	<u>Twirl time</u>	<u>Spacing</u>
MD	10 seconds	4 seconds	*
MA	none	none	*
OR	8 seconds	4 seconds	1000 feet
TX	10 seconds	2 seconds	*
<u>Rural Roads Only</u>			
WA	8 seconds	4 seconds	*

Model state statutory and regulatory language

California

Business and Professional Code 5405(d) (1)

(d) (1) "Message center displays that comply with all requirements of this chapter. The illumination or the appearance of illumination resulting in a message change of a message center display is not the use of flashing, intermittent, or moving light for purposes of subdivision (b) of Section 5408, except that no message center display may include any illumination or message change that is in motion or appears to be in motion or that changes in intensity or exposes its message for less than four seconds. No message center display may be placed within 1,000 feet of another message center display on the same side of the highway. No message center display may be placed in violation of Section 131 of Title 23 of the United States Code."

Connecticut

Sec. 32, Section 13a-123 (f)

(f) Notwithstanding the provisions of subsections (a) and (e) of this section, signage that may be changed at intervals by electronic or mechanical process or by remote control shall be permitted within six hundred sixty feet of the edge of the right-of-way of any interstate, federal-aid primary or other limited access state highway, except as prohibited by state statute, local ordinance or zoning regulation, provided such signage (1) has a static display lasting no less than six seconds, (2) achieves a message change with all moving parts or illumination moving or changing simultaneously over a period of three seconds or less, and (3) does not display any illumination that moves, appears to move or changes in intensity during the static display period.

Florida

Section 14-10.0009 F.A.C., Chapter 479

The FL DOT interprets the lighting provisions of the State/Federal Agreement (as enunciated in Section 14-10.0009 F.A.C.) and Chapter 479, F.S. to allow the permitting of off-premise, changeable message signs under the following conditions: 1) Changeable message signs will be permitted regardless of the technology that is used, except, if such signs contain, include or are illuminated by any flashing, intermittent, or moving light or lights (other than signs giving public service information such as time, date, temperature, weather, or similar information), they are prohibited; 2) Permitting of changeable message signs will be limited to conforming signs, since applying the modern technology of such signs to nonconforming signs is considered a substantial change not allowed by subsection 14-10.0007 (2) (a) and 23 CFR 750.707 (d) (5); 3) Changeable message signs will be required to meet the remaining regulatory criteria of Chapter 479, F.S. and Chapter 14-10 F.A.C. including limitation of spacing to

1,000 feet on the federal-aid primary highway system and 1,500 on the interstate highway system; and 4) Frequency of message change will be limited by Rule to six (6) second minimum display time, with a two (2) second maximum change time.

Ohio

Chapter 5501: 2-2-02 Admin. Code (B)

(B) "Multiple message and variable message advertising devices: such advertising devices may be permitted on the interstate system or the primary system under the following conditions:

- (1) Each message or copy shall remain fixed for at least eight seconds;
- (2) When a message or copy changes by remote control or electronic process, it shall be accomplished in three seconds or less;
- (3) No such advertising device shall be placed within one thousand feet of another multiple message or variable message advertising device on the same side of the highway visible in the same direction of travel;
- (4) Such advertising devices shall contain a default design that will freeze the device in one position if a malfunction occurs;
- (5) Any maximum size limitations shall apply independently to each face of a multiple message or variable message advertising device; and
- (6) Only one multiple message advertising device shall be permitted at a single location facing the same direction."

Suggested Definition

Any outdoor advertising sign which displays a series of advertisements, regardless of technology used; such sign changes will not be considered moving, flashing, or intermittent lights or moving parts and will be deemed a change of copy only. Such multiple message signs may be permitted on the interstate system or the primary system under the following conditions:

- 1.) No revolving or rotating beam or beacon of light that simulates any emergency light or device shall be permitted as part of any sign. No flashing, intermittent, or moving light or lights will be permitted except scoreboards and other illuminated signs designating public service information, such as time, date, temperature, or similar information, will be allowed;
- 2.) Each message or copy shall remain fixed for at least six seconds;
- 3.) Multiple message signs are allowed on existing structures and future structures to be built, as long as they comply with existing state spacing regulations;
- 4.) When a message or copy changes, it shall be accomplished in three seconds or less;
- 5.) Such multiple message signs shall contain a default design that will freeze the device in one position if a malfunction occurs;
- 6.) Any maximum size limitations shall apply independently to each face of a multiple message sign;
- 7.) Such structures may be erected as a single face, back-to-back, V-type, or side-by-side.

Pennsylvania "Strike-off" Letter

OS-600 (3-89)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

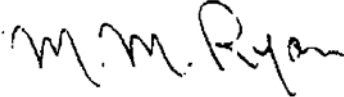
DATE: April 24, 2002

430-02-16

SUBJECT: Outdoor Advertising Control
Changeable Message Signs

TO: All District Engineers/District Administrator

FROM: Michael M. Ryan, P.E.
Deputy Secretary for
Highway Administration



Outdoor advertising companies are increasing the use of signs that are capable of changing messages by an electronic process or remote control. This strike-off letter establishes a policy that allows the use of such signs for off-premise advertising purposes in a manner that is consistent with the requirements of applicable laws and regulations.

A. Introduction

Messages change on nearly all signs. Traditionally this was done by posting a paper copy of the message on a sign face or by hand painting a message. More recently, preprinted vinyl covers are stretched on a sign structure. The interval of time between these kinds of message changes is days, months, or years.

Outdoor advertising signs are intended to attract the attention of passing motorists. However, such attraction should not distract the motorist from the primary task of safely operating the motor vehicle.

Technology has significantly shortened the duration of message change interval to less than a second for certain types of signs by using an electronic process or remote control. Such changeable message displays include rotating panels, glow cubes, electronically controlled lights, video displays, and other types and methods, including those not yet invented. There is nothing in the Outdoor Advertising Control Act No. 160 of 1971 or Title 67 Pa. Code Chapter 445, Outdoor Advertising Devices, which specifically addresses the duration of message change interval. Thus, it is appropriate that the Department establish a policy regarding safe and reasonable message change intervals to promote the orderly display of outdoor advertising consistent with the Act's purpose.

Outdoor Advertising Control
Changeable Message Signs

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B. Legal Considerations

Act No. 160 of 1971, the Outdoor Advertising Control Act, 36 P.S. 2718.101 et. seq. prohibits signs that contain, include or are illuminated by a flashing, intermittent or moving light or lights, except those providing public service information such as time, date, temperature, weather or similar information. However, a Department Hearing Officer has determined that 'Tri-vision' and 'glow-cube' type displays do not violate the Act, since such displays are not flashing or intermittent. (Outdoor Advertising Device Permit No. 11-5038, J.B. Steven, Inc., SR 279, Borough of Carnegie, Allegheny County, No. 006 A.D. 1994, decision of April 19, 1995.)

It is appropriate in implementing State law and regulation to require that, for all types of changeable message displays, the frequency of message change should be uniformly established as a matter of policy consistent with Department regulation.

The Federal Highway Administration has made it clear that it is up to the Department to determine the frequency of message change for all changeable message type displays, so long as such displays comply with State law.

Other states allow changeable message displays. States that regulate the timing of Tri-Vision displays generally allow for an Exposure Dwell Time of 4-6 seconds. It is reasonable for the Department to consider the standards set by other states in deciding what the message display interval for controlled advertising devices should be. However, the message change interval must be consistent with the stated purpose of the Outdoor Advertising Control Act of "...assuring the reasonable, orderly and effective display of outdoor advertising while remaining consistent with the national policy to protect the public investment in the interstate and primary systems; to promote the welfare, convenience and recreational value of public travel; and to preserve natural beauty", 36 P.S. Section 2718.102.

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Changeable Message Signs

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There is no reference to the term "viewing zone" in the Outdoor Advertising Control Act or Department regulations, Title 67, Pa. Code, Chapter 445. However, the Highway Vegetation Control Act, Act No. 79 of 1983, 36 P.S. section 2720.1 et. seq., which allows for the removal of vegetation screening billboards, does address the concept of a "viewing zone". The Vegetation Control Act defines "obstruction of view" as: *When the intent of the advertising is not discernible for a total of five seconds in the viewing zone.* The Act further defines the viewing zone as: *That distance measured along the center of the lane of traffic of a highway which a vehicle will travel at the posted speed limit.* This language indicates the General Assembly's recognition that a motorist traveling the interstate system needs at least 5 seconds to view and assimilate an outdoor advertising device. Thus, the Vegetation Control Act provides a basis for establishing a message change interval or Exposure Dwell Time (EDT) of at least 5 seconds.

C. Policy Applicable to Change of Message

The following policy applies to all off-premise outdoor advertising signs, located in zoned or unzoned commercial or industrial areas, and which conform to the requirements of Act No. 160 of 1971 and Title 67 Pa. Code Chapter 445, where the message or any part of the display area of a sign can be changed by electronic process or remote control:

1. All messages/displays shall remain unchanged for a minimum of five (5) seconds.
2. The time interval used to change from one complete message/display to the next complete message/display shall be a maximum of one (1) second.
3. There shall be no appearance of a visual dissolve or fading, in which any part of one electronic message/display appears simultaneously with any part of a second electronic message/display.

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Changeable Message Signs

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4. There shall be no appearance of flashing or sudden bursts of light, and no appearance of animation, movement, or flow of the message/display.
5. Any illumination intensity or contrast of light level shall remain constant.

D. Application for Outdoor Advertising Device Permit

Item D.3. of the sign permit application reflects the prohibition in the law of flashing, intermittent, or moving lights. In addition, it asks whether or not the sign will include an electronically controlled message board. This will be revised to ask whether or not the sign message/display area will be controlled by electronic process or remote control. If the applicant responds, "yes", the permit will be granted under the condition that the applicant agrees to the policy provided above.

If there are questions or discussion, contact Doug Lehr at 717-787-9829.

4350/DWL/bjg

cc: M. M. Ryan, P.E., 8th Floor - CKB
G. L. Hoffman, P.E., 7th Floor - CKB
D. Spila, Acting Policy Director, 8th Floor - CKB
A. C. Bhajandas, P.E., 7th Floor - CKB
R. M. Peda, P.E., 6th Floor - CKB
T. E. Bryer, P.E., 6th Floor - CKB
D. A. Schreiber, P.E., 7th Floor - CKB
Bureau of Design Division Chiefs
All District Right-of-Way Administrators
Right-of-Way Section Chiefs
J. A. Cheatham, FHWA
W. J. Cressler, Legal, 9th Floor, CKB
A. Cromleigh 7th Floor - CKB
Penny Frey, Bureau of Office Services, 5th Floor, CKB

*Driving Performance in the
Presence and Absence of Billboards*
EXECUTIVE SUMMARY

Prepared for

Foundation for Outdoor Advertising Research and Education

By Suzanne E. Lee, Erik C. B. Olsen, and Maryanne C. DeHart

Center for Crash Causation and Human Factors

December 15, 2003

EXECUTIVE SUMMARY

Introduction

The current project was undertaken to determine whether there is any change in driving behavior in the presence or absence of billboards. Several measures of eyeglance location were used as primary measures of driver visual behavior. Additional measures were included to provide further insight into driving performance--these included speed variation and lane deviation. The overall conclusion from this study is that the presence of billboards does not cause a change in driver behavior in terms of visual behavior, speed maintenance, or lane keeping. A rigorous examination of individual billboards that could be considered to be the most visually attention getting demonstrated no relationship between glance location and billboard location. Driving performance measures in the presence of these specific billboards generally showed less speed variation and lane deviation. Thus, even in the presence of the most visually attention-getting billboards, neither visual behavior nor driving performance changed.

Methods

Participants in this study drove a vehicle equipped with cameras in order to capture the forward view and two views of the driver's face and eyes. The vehicle was also equipped with a data collection system that would capture vehicle information such as speed, lane deviation, GPS location, and other measures of driving behavior. The video and other data were linked by use of a common time numbering system, and all data were collected at the rate of 10 times per second.

Thirty-six drivers participated in the study. Participants were unaware of the focus of the study on billboards; they were told that the purpose of the study was to examine natural driving behavior, which was also true. The drivers were a diverse group in terms of age, gender, income, education, and ethnicity. They were all familiar with at least some segments of the test route, which was a 35-mile loop route in Charlotte, North Carolina. The route included both interstate and surface streets, and it was mostly urban and suburban in nature. A total of 30 billboard sites along the route were selected with assistance from a Charlotte,

North Carolina outdoor advertising company and representatives from the Outdoor Advertising Association of America (OAAA). The route included billboards of various sizes, on both sides of the road, and on both interstates and surface streets. In addition, six comparison sites (e.g., logo signs, on-premises signs, etc.) and six baseline sites (i.e., no visual elements such as buildings or signs present) were included for comparison purposes.

Participants were oriented to the study and the experimental vehicle before they began driving the route. After a short practice route with the experimenter, each participant drove the route unaccompanied and with the assistance of route directions mounted on the dashboard. Data were collected unobtrusively by using hidden sensors. The data were then stored on compact disks for later analysis. After returning to the starting point, drivers completed a demographic and driving questionnaire and were then paid a token amount in appreciation for their time.

The experiment was designed so that the elements of participant age (younger/older), participant gender (male/female), side of road (left/right), and type of site (billboard, comparison, or baseline) were equally represented. Several measures were used to determine whether driver behavior varied during the 7-seconds preceding the billboard site (as compared to other types of sites).

These included measures of visual behavior (eyeglance locations of forward, left, and right) and driving performance (lane deviation and speed variation). The measures were statistically analyzed in terms of the controlled elements of site type, age, gender, and route, as well as by road type and familiarity. An additional analysis examined visual and driving performance in the presence of certain high-profile billboards that might be expected to be the most attention-getting along the route.

The eyeglance data were analyzed by four trained data analysts who used a customized software package. The software used GPS location data for site, route, and vehicle identification on an electronic road map. Glances were analyzed down to a tenth of a second, in terms of both length of glance and glance locations. Analysis of vehicle speed and lane position variability was accomplished with a computerized post-processing procedure on the raw data file. Each analyzed event was 7 seconds long.

With 36 participants and 42 sites, there were 1,512 events available for analysis from approximately 54 hours of data collection. A small amount of data was lost due to sensor outages, sun angle, and lane changes, leaving 1,481 events for eyeglance analysis and 1,394 events for speed and lane position analysis. Altogether, 103,670 video frames were analyzed and 10,895 glances were identified. There were 97,580 data points in the speed and lane position data set.

Questionnaire Results

The average participant age was 25 years for younger drivers and 56 years for older drivers. On average, drivers had completed 14 years of education (high school plus two years of college).

For marital status, 78% of participants were single or married, while 14% were divorced and 8% widowed. Over 61% of drivers were European (Caucasian) and 39% of drivers had an African American, Native American, or Multi-racial background. Seventy-two percent of drivers reported an annual income of less than \$49K. All drivers were familiar with the roadway system in Charlotte, North Carolina and most drivers both lived and worked there.

Analysis of the questionnaire results revealed that the most common items that caught drivers' attention during the route were traffic, other drivers, road signs, and highway signs, as well as construction, landmarks, landscaping, and buildings. Only 25% of drivers indicated that billboards caught their attention during the drive. Upon further discreet inquiry, these drivers indicated that they either tended to look at billboards in general or at specific billboards that caught their attention.

Other questions asked drivers to indicate what was memorable about the drive or what they noticed about other drivers. Most comments involved traffic, construction, the weather, or aggressive driving by other drivers. Many drivers indicated that they typically also performed other activities while driving, such as listening to music, talking on a cell phone, eating, drinking, smoking cigarettes, or talking to passengers. The last question asked drivers to reiterate the purpose of the study; all of the drivers indicated that the study was designed to examine natural driving behavior, which is what they had been told at the beginning.

Visual Behavior Results

The visual behavior results indicate that billboards do not differ from comparison sites such as logo boards, on-premises advertisements, and other roadside items. The analysis of eyegance patterns provided insight as to whether drivers displayed more active glance performance when passing billboards. Glances were analyzed in terms of number of glances, average duration of glances, and total duration of glances for each of three site types: billboard, baseline, and comparison sites. Billboard sites did not differ significantly from the comparison sites for leftforward glances, but did differ from baseline sites. There were also a difference in terms of leftforward total glance duration; billboard and comparison sites had significantly longer leftforward total glance durations than baseline sites, but did not differ from one another. There were no differences for the average glance durations in any direction between three site types.

Out of nine visual performance measures, there were no cases for which the billboard site type differed significantly from the comparison site type, and only two cases for which both billboard and comparison sites differed from baseline sites.

In terms of side of road, age, or familiarity, no differences were found for eyeglance behaviors, and there was only one difference for gender. Females displayed longer average and total rightforward glance durations across all site types; this difference, although significant, was relatively small in terms of magnitude and does not appear to have any practical significance.

Not surprisingly, there were significant differences for road type, with surface streets showing a more active glance pattern than interstates. More glances were observed in all directions on surface segments, as compared to interstate segments. The average and total center forward glance durations were longer for the interstate segments; in most cases, the right- and leftforward average and total glance durations were shorter on the interstate than on surface streets.

In most cases, surface road sites have more signs, buildings, and other features closer to the side of the road, so it is not surprising that drivers would look at locations other than center forward while driving in these areas.

Speed Variability Behavior Results

Speed maintenance behavior did not differ in the presence of billboards as compared to comparison and baseline sites. Significant differences were found for side of road, familiarity, and road type; however, from a practical perspective, differences were small. Sites on the right were associated with less speed variation than those on the left. Drivers also exhibited less speed variation for sites rated as familiar. The largest difference was in terms of road type--sites on the interstate had less speed variability than did sites on the surface streets.

Lane Deviation Behavior Results

Lane maintenance behavior did not differ in the presence of billboards as compared to comparison and baseline sites. Lane position analysis revealed differences only for side of road.

For sites on the left side of the road, lane position varied by 10 inches during the 7-second segment, as compared to 7.5 inches for sites on the right side. These differences, although significant, are within the expected range of deviation.

Specific Board Analysis Results

An analysis of specific boards was performed to determine: 1) how specific billboards compared to other billboards as well as specific baseline and

comparison sites in terms of eyeglance and driving performance measures, and 2) how the eyeglance measures corresponded to the placement of the billboards (left or right) in relation to the road. By choosing the four billboards that might be expected to draw the most glances, as well as two more ordinary boards, and comparing their results to all other sites, it became obvious that the selected billboards did not change visual performance. Some billboard sites seemed to have a more active glance pattern than others, but this was most likely due to road type differences, since the glance directions at these sites did not correspond to the side of the road where the billboards were situated.

Study Parameters

This study was conducted in a specific city chosen to be representative of mid-sized U.S. cities. The route was chosen to include both urban and suburban sections (and some sections were close to rural in nature). The billboards in Charlotte, North Carolina are generally situated close to the side of the road, therefore placing the boards within the forward-view of the participants for a longer period of time than if they were further offset from the road. Both the setting (urban/suburban/rural) and the billboard offsets were typical of most billboard locations found in the U.S. For each of the above-mentioned parameters, every attempt was made to conduct a balanced, representative study for which the results could be generalized to other cities and routes.

One limitation of this study was that there were few electronic boards along the route, so no conclusions can be drawn regarding driver behavior in the presence of this type of billboard. All three of the electronic billboards available on the route were included, however, for a total of 10% of the sampled billboards. Future research into this topic should focus on routes with a greater number of available electronic billboards so that an electronic/non-electronic analysis can be conducted.

Conclusions

The overall conclusion from this study is that the presence of billboards does not cause a change in driver behavior, in terms of visual behavior, speed maintenance, or lane keeping. A rigorous examination of individual billboards that could be considered to be the most visually attention-getting demonstrated no relationship between glance location and billboard location. Driving performance measures in the presence of these specific billboards generally showed less speed variation and lane deviation. Thus, neither visual behavior nor driving behavior changes, even in the presence of the most visually attention-getting billboards.