

**THE USE OF COMMERCIAL ADVERTISING ON LARGE SCALE  
ELECTRONIC BILLBOARDS FOR HIGHWAYS AND THEIR RELATION  
TO DRIVER SAFETY AND DRIVER DISTRACTION**

**Literature Review**



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DISTRACTION**

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by

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### **NOTE:**

This report contains hyper-links within the document, references and appendices. These are intended for the reader to be able to quickly reference the materials cited by the author when reading this document in electronic format.

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## **1.0 INTRODUCTION**

The potential for driver distraction on highways is a major safety concern for state departments of transportation (DOTs). In the current technological climate, drivers have the potential to be distracted by cell phones, mp3 players and other media devices. Other technology, such as digital billboards, can also potentially disrupt driver concentration. Though billboards and other outdoor advertising have been used in the United States for over 100 years (*Outdoor Advertising Association of America 2006*), the advent of high quality graphics on digital billboards presents new, unknown variables. Digital billboards are extremely bright signs that often display flashing or blinking messages, possibly even video and are being produced in sizes that (with enhanced quality) makes them visible from longer distances.

The purpose of this report is to review studies and publications on the relation of large digital billboards to driver distraction and overall highway safety.

## **2.0 BACKGROUND**

Although there have been several articles and comments on the use of digital or electronic billboards, the Oregon Department of Transportation (ODOT) and the City of Salem found themselves discussing this topic in May 2008. These talks were brought about with the recent placement of four, large-scale, high-quality electronic billboard signs on major arterials throughout Salem. One of these signs was visible to interstate traffic along I-5, in Oregon<sup>1</sup>.

ODOT, in collaboration with the City of Salem, conducted this review of the existing literature in order to better understand the national perspective on the issue of electronic billboards and highway safety, and to achieve a specific focus within the northwest. This literature review is intended to assist local and state officials to determine the appropriate course of action within this topic area.

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<sup>1</sup> At the time of publication of this report, ODOT had not yet determined if this sign was subject to state sign regulations.

### 3.0 HISTORY

According to the 2006 U.S. Census Bureau report, there were 43,443 fatalities in the U.S. in 2005. The number of people killed has increased by an average of 0.4 percent per year between 1996 and 2005 (*National Highway Traffic Safety Administration 2007*).

A common cause of vehicular incidents is ‘distraction’. In addition to incidents leading to fatalities, the inability of drivers to concentrate on the road can lead to physical injury to themselves or to others (*Johns 2007*). The size and newer technology of Electronic Billboard Signs (EBBs), also referred to as Commercial Electronic Variable Message Signs or Digital Billboards, makes them much clearer from a distance than older generation signs. The intent of commercial electronic billboards is to relay an advertising message to the consumer, which places them in direct competition for the attention needed to operate a motor vehicle.

The topic of distracting billboards and signage is a national issue facing city, county, and state roads. Individual State DOTs have varying regulations addressing the use of such signs on highway right-of way, with some unifying guidance from organizations like the Federal Highway Administration (FHWA). Historically, roadside advertising has been mandated, such as by the Highway Beautification Act of 1965. Advertising that could distract or impair the driver’s vision (*Farby et al. 2001*) was removed from highways under the Highway Beautification Act of 1965 (*FHWA 2008*).

Additional issues with EBB’s have surfaced with the allowance of these signs on private property, by permit. In some cases EBBs are placed in the city, intended for a city arterial, however, they are also visible to the drivers on other nearby highways. This raises a question as to what constitutes a driver’s line of sight when a city arterial sign is visible from the highway, and what laws may be applicable due to the increased size and quality of images. EBBs installed on privately owned land may apply for permits within cities and/or counties, which may have contrasting and even conflicting sets of laws governing their levels of use; ranging from prohibition to full use with few limitations.

State DOT’s are becoming more involved with city and/or county entities when permits for use of large scale EBBs are granted in an effort to keep some uniformity. In researching materials on this topic, there were four underlying factors that state agencies and city/county governments seemed most concerned with when determining the use of EBBs at local levels. They were:

- Driver safety;
- Current local regulations and codes, including neighboring city codes and decisions regarding the use of EBBs;
- Ability to partner with private companies to display beneficial information to the public (Amber alerts, Traffic notices, Homeland security notices, etc); and
- Aesthetics.

## 4.0 DRIVER SAFETY

Several studies on the use of outdoor advertising and driver distraction have been conducted over the years. General findings by Treat (1979) indicated that the use of advertising billboards contributes to driver's inattentiveness while operating a vehicle.

According to field and laboratory studies conducted by Hughes and Cole (1986), the use of roadside advertising accounted for 10.2 percent of driver distraction, compared to 18.3 percent associated with traffic control devices. In line with this matter, the study of Wang *et al.* (1996) revealed that 3.2 percent of vehicular crashes, occurring each year, were triggered by external distracting objects<sup>2</sup>.

Additionally, a study in 1996 showed billboards that were erected along roadsides could detract from the visibility of traffic lights (Akagi *et al.*). A later, separate study reported that drivers tend to have a longer eye fixation on advertisement billboards, as compared to traffic control signs such as pedestrian or speed limit signs (Luoma 1998).

The Federal Highway Administration published a final report in 2001 outlining current knowledge of EBBs and safety, and outlined specific research needs (Farby *et al.*). This report was followed by a 2007 FHWA memorandum (Shepherd), providing additional guidance on the use of EBBs.

In a 2006 National Highway Traffic Safety Administration (NHTSA) study, driver eye-movement behavior indicated that total eyes-off-road durations of greater than 2 seconds significantly increased individual near-crash/crash risk (Klauer *et al.*). Two of the four types of driver inattention researched were: driving-related inattention to the forward roadway; and non-specific eye-glances away from the forward roadway (Klauer *et al.* 2006).

Two industry sponsored studies, completed in 2007 by Tantala and Tantala, and Lee *et al.*, claimed that EBBs were no more likely to cause traffic accidents than conventional billboards (Outdoor Advertising Association of America 2007b). These findings have since been rebutted in a report critical of the conclusions and methodology of both studies (Wachtel 2007).

In the May 2008 *Institute of Traffic Engineers (ITE) Journal*, the use of EBBs, their background, regulations, and additional pro's and con's are discussed in detail (Birdsall 2008).

Though several studies on the relationship of EBBs and driver distraction have been conducted, there is a need for additional research in the area of driver distraction and the benefits of electronic signs. When the use of large electronic billboards is considered, the

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<sup>2</sup> Referring to people, situation that occurs outside the vehicle, and other non-specific objects; this study did not specifically consider billboards to be one of external causes of distraction.

following physical properties were identified as some of the factors that need to be addressed when evaluating driver safety on highways (*NHTSA 2000*):

- size of the object;
- readability of advertising texts;
- color and object contrast with its background;
- complexity of the background; and
- boldness of graphics

## 5.0 CURRENT REGULATIONS

Current regulations on the use of Electronic Billboard Signs vary nationally, regionally, and locally. A Wisconsin DOT Synthesis report identified the lack of governance on standards for EBBs and discussed additional ideas for identifying if crashes were related to extra-vehicular distraction, like EBBs (*CTC & Associates LLC, WisDOT RD&T Program 2003*).

After the 1958 Bonus Act (*California DOT 2007*) and the Highway Beautification Act of 1965 was implemented throughout the United States, many amendments and new Acts were made to strengthen the regulation on advertising signs, including large-scale electronic billboards (FHWA 2008). These include:

- [1968 amendments to Highway Beautification Act of 1965](#);
- [Federal-Aid Highway Acts of 1970, 1974, 1976](#);
- [Intermodal Surface Transportation Efficiency Act of 1991](#); and
- [Dire Emergency Supplemental Appropriations Act of 1992](#).

Despite USDOT's efforts to promote driver safety, there are continuing problems with the lack of uniformity in existing regulations on outdoor advertising from one state to another. Thirty-six states highly regulate the use of red, flashing, intermittent, or moving lights on large electronic or non-electronic billboards. Twenty-nine states prohibit signs that use illumination, which can interfere with traffic light controls. Only nine states have implemented specific regulations governing signs (*Farby et al. 2001*).

Since there is a need for more research in the field of driver distraction effects of EBBs, local governments are looking for direction from state DOTs and national entities, like FHWA, to help guide their use and regulate EBB deployment at a local level. However, FHWA has taken a neutral stance, "FHWA currently has no scientific basis on which to prohibit the signs. FHWA is not endorsing the billboards, but rather allowing states to make their own decisions about them" (*Birdsall 2008*).

In the *Webpavement* web blog, the following various billboard laws across the US are discussed (*Webpavement WebBlog 2005*):

- “California electronic billboards are restricted from changing displays more often than every four seconds.”
- “In Nevada, full-motion billboards are allowed on the Las Vegas Strip.”
- “Georgia forbids electronic billboards that change messages more often than every 10 seconds.”
- “Other states set an 8-second minimum between changes.”
- “In Pittsburgh, the City Council recently passed a law that limits electronic signs to amber text or images on black background. Under that regulation, electronic message boards must be incorporated within traditional signs. They may be no larger than 24 square feet per side, each message must stay in place for at least 15 seconds, and no animation is allowed.”

Tulsa, Oklahoma has posted their city ordinance revisions dealing with these EBBs (*TulsaNow Web Forum 2008*). The Outdoor Advertising Association of America (OAAA) has posted some state statues for Connecticut, Florida, and Ohio. The City of Wheeling has also posted definitions and Off-Premise Signs section to their city ordinances (*OAAA 2007a*).

In the northwest, few large-scale commercial EBBs have been allowed to be displayed on interstates without the consent of the state DOT. However, in 1997, a unique situation occurred where-in a large scale sign was installed, against the DOT recommendation, on I-5 in Washington State. This large EBB was installed on Indian Tribal land (Pierce/King County line) which abutted the I-5 highway. A letter from the Washington State Regional Traffic Engineer, dated June 19, 2002 (*McCormick*), recommended against an additional sign on the I-5 corridor, citing previous experience with EBBs for Washington State. In this letter, the traffic engineer cites crash data which supports safety concerns that a large scale EBB could cause more distraction to drivers, and therefore lead to more accidents.

In a phone interview with Bill Legg, WSDOT ITS State Engineer (2008), described a nine-month period before and after the installation of the sign. The findings of the study revealed that traffic speeds, overall, decreased on the segment where the sign was visible and that there was no statistically significant change in accident rates. Unfortunately, WSDOT does not have this study on file, citing an archiving error. On further discussion, Mr. Legg’s comments revealed that the original Pierce/Kings county sign has since dimmed (illumination), whether through years of use or by design, and has less contrast. A newer sign on I-5, south of Olympia (Tulalip Tribes Casino), has a dimmer feature (illumination) and he believes it is a benefit to drivers during the evening hours due to the lessened contrast of the sign.

## **6.0 FUTURE REPORTS**

FHWA is updating their 1980 and 2001 studies in this topic area. The updated report is scheduled for publication in 2009. There is also a National Cooperative Highway Research Program (NCHRP) project (20-07/Task 256) that is also due in 2009, called “Safety Impacts of Emerging Digital Display Technology for Outdoor Advertising Signs.”

The newly formed Transportation Research Board (TRB) subcommittee for Digital Signage is also expected to conduct research in this topic area (*Wachtel 2007*).

## **7.0 CONCLUSION**

In summary, regulations on electronic billboards differ from state to state and from city to city. More guidance is needed from Federal entities if a national standard is going to be implemented. Additional research needs to be done in the area of driver distraction with a specific emphasis on the newer, graphically enhanced billboards. Some key studies in this area are currently underway. Many cities have opted to regulate these EBBs based on public safety, public opinion, tax gain, public service announcements (e.g. Amber Alert), and aesthetics.

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## Select Bibliography

Listed are other materials found during this research that were not referenced, but help support the writing and conclusion. This is intended to serve as a convenience for those wishing to pursue the study of EBBs and their affects on driver distraction in the future.

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Beirness, D., J. Stutts, D. Strayer, S.G. Klauer, F. Bellavance. 2005. "[How risky is Distracted Driving – OVERBLOWN OR UNDERSTATED?](#)" International Conference on Distracted Driving. Toronto, Canada. October 2-5, 2005.

Other useful web sites on this topic:

<http://www.NAHBA.org>

<http://www.transportation.org/>

<http://www.oaaa.org/>

<http://www.byways.org/>

**APPENDIX A:  
WASHINGTON DOT EBB REGULATION AS OF JUNE 2008**

Under these rules, the EBB sign in this discussion would be considered to be a Type 3 on premise sign, electronic signs are allowed only as type 3 signs under WAC 468-66-050(3)(g):

(g) Electronic signs may be used only as Type 3 on-premise signs and/or to present public service information, as follows:

(i) Advertising messages on electronic signboards may contain words, phrases, sentences, symbols, trademarks, and logos. A single message or a message segment must have a static display time of at least two seconds after moving onto the signboard, with all segments of the total message to be displayed within ten seconds. A one-segment message may remain static on the signboard with no duration limit.

(ii) Displays may travel horizontally or scroll vertically onto electronic signboards, but must hold in a static position for two seconds after completing the travel or scroll.

(iii) Displays shall not appear to flash, undulate, or pulse, or portray explosions, fireworks, flashes of light, or blinking or chasing lights. Displays shall not appear to move toward or away from the viewer, expand or contract, bounce, rotate, spin, twist, or otherwise portray graphics or animation as it moves onto, is displayed on, or leaves the signboard.

(iv) Electronic signs requiring more than four seconds to change from one single message display to another shall be turned off during the change interval.

(v) No electronic sign lamp may be illuminated to a degree of brightness that is greater than necessary for adequate visibility. In no case may the brightness exceed 8,000 nits or equivalent candelas during daylight hours, or 1,000 nits or equivalent candelas between dusk and dawn. Signs found to be too bright shall be adjusted as directed by the department.

**APPENDIX B:  
OREGON DOT EBB REGULATION AS OF JUNE 2008**

**377.720 Prohibited signs; exceptions.** A sign may not be erected or maintained if it:

- (1) Interferes with, imitates or resembles any traffic control sign or device, or attempts or appears to attempt to direct the movement of traffic.
- (2) Prevents the driver of a motor vehicle from having a clear and unobstructed view of traffic control signs or devices or approaching or merging traffic.
- (3) Contains, includes or is illuminated by any flashing, intermittent, revolving, rotating or moving light or moves or has any animated or moving parts. This subsection does not apply to:
  - (a) A traffic control sign or device.
  - (b) Signs or portions thereof with lights that may be changed at intermittent intervals by electronic process or remote control that are not outdoor advertising signs.
  - (c) A tri-vision sign, except that a tri-vision sign may not be illuminated by any flashing, intermittent, revolving, rotating or moving lights.
- (4) Has any lighting, unless such lighting is so effectively shielded as to prevent beams or rays of light from being directed at any portion of the main traveled way of a state highway, or is of such low intensity or brilliance as not to cause glare or to impair the vision of the driver of a motor vehicle or otherwise to interfere with the operation thereof.
- (5) Is located upon a tree, or painted or drawn upon a rock or other natural feature.
- (6) Advertises activities that are illegal under any state or federal law applicable at the location of the sign or of the activities.
- (7) Is not maintained in a neat, clean and attractive condition and in good repair.
- (8) Is not able to withstand a wind pressure of 20 pounds per square foot of exposed surface.
- (9) Is on a vehicle or trailer that is located on public or private property. This subsection does not apply to a vehicle or trailer used for transportation by the owner or person in control of the property. [1971 c.770 §15; 1973 c.790 §3; 1977 c.256 §2; 1981 c.392 §1; 1999 c.877 §4; 2007 c.199 §8]

**APPENDIX C:  
OTHER OREGON REGULATIONS AS OF JUNE 2008**

**734-020-0005** Manual on Uniform Traffic Control Devices

Legal Reference [click here](#)

[Federal Highway listing of the MUTCD](#)

[Oregon.gov listing of Supplement to MUTCD](#)

**Prohibited Activities on State Highway Right-of-Ways**

**734-020-0095** Prohibited Activities

Legal Reference [click here](#)

**Standards for Installation, Operation and Use of Traffic Control  
Signal Operating Devices**

(See web link above)

**734-020-0300** Purpose

**734-020-0310** Definitions

**734-020-0320** Standards for Installation and Operation of Emergency Preemption and  
Bus Priority Systems

**734-020-0330** Standards for Use of Traffic Control Signal Operating Devices

**APPENDIX D:**  
**LUBA (OREGON LAND USE BOARD OF APPEALS) LEGAL**  
**NOTES WITH REGARD TO EBBS AS OF JUNE 2008**

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** Where a local ordinance that restricts the size of all electronic signs except those operated by government agencies as public signs is not concerned with the content of the messages being displayed on the electronic signs, under Article I, Section 8 of the Oregon Constitution, the ordinance is a content neutral restriction on speech that is a reasonable time, place and manner restriction. *Lamar Advertising Company v. City of Eugene*, 54 Or LUBA 295 (2007).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** In the absence of evidence in the record indicating that a local government is allowing certain private parties to use government signs to display private commercial messages and that use results in discrimination against particular speakers, no violation of Article I, Section 20 of the Oregon Constitution has occurred. *Lamar Advertising Company v. City of Eugene*, 54 Or LUBA 295 (2007).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** A broad and poorly defined sign code prohibition on “billboards” does not necessarily require inquiry into the content of signs, or allow content-based distinctions, where as interpreted by the city the code allows or prohibits all signs, including “billboards,” based on specific standards that do not require inquiry into the content of proposed signs. *Media Art v. City of Tigard*, 46 Or LUBA 61 (2003).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** An argument that a sign code definition of “image” impermissibly distinguishes between content because it regulates representational images but not abstract images does not provide a basis for reversal or remand, where nothing in the sign code narrows the scope of the term “image” to exclude abstract or non-representational images. *Cotter v. City of Portland*, 46 Or LUBA 612 (2004).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** In the absence of a content-neutral way of distinguishing wall murals from other types of signs, a city’s regulatory choice lies between deregulating signs altogether or regulating murals along with signs. A city’s choice to regulate murals along with signs does not violate Article I, section 8 of the Oregon Constitution, where graphic expression by muralists is burdened only to the same extent as other types of constitutionally protected expression. *Cotter v. City of Portland*, 46 Or LUBA 612 (2004).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** A city’s failure to address subjective language in a sign code criterion does not provide a basis for

reversal or remand, where the petitioner also argues that applying that code language to approve or deny a sign application would be inconsistent with Article I, section 8 of the Oregon Constitution. *Cotter v. City of Portland*, 46 Or LUBA 612 (2004).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** That the record does not contain evidence of the specific content of proposed billboards does not indicate that a city’s denial of the billboards was not content-based, where the city’s sign ordinance defines permitted signs by content, the city denied the proposed signs because they were not among the types of signs allowed by the ordinance, and the city’s denial reflects a belief or assumption about the types of speech the proposed billboards would not include. *West Coast Media v. City of Gladstone*, 44 Or LUBA 503 (2003).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** A sign ordinance that defines and regulates six permitted types of signs, and implicitly prohibits all others, necessarily requires inquiry into the content of the proposed sign in order to determine which if any of the six permitted categories and six different sets of standards apply. *West Coast Media v. City of Gladstone*, 44 Or LUBA 503 (2003).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** While distinction between “off-premises” and “on-premises” signs is not necessarily a content-based distinction in violation of Article I, section 8 of the Oregon Constitution, a sign ordinance that allows some types of off-premises speech and prohibits others necessarily distinguishes between speech based on content, and is therefore inconsistent with Article I, section 8. *West Coast Media v. City of Gladstone*, 44 Or LUBA 503 (2003).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** A sign ordinance that impermissibly allows certain types of speech while prohibiting other types of speech based on content in violation of Article I, section 8 of the Oregon Constitution may also, for the same reason, violate the equal privileges and immunities clause under Article I, section 20. *West Coast Media v. City of Gladstone*, 44 Or LUBA 503 (2003).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** That the record does not contain evidence of the specific content of proposed billboards does not indicate that a city’s denial of the billboards was not content-based, where the city’s sign ordinance defines permitted signs by content, the city denied the proposed signs because they were not among the types of signs allowed by the ordinance, and the city’s denial reflects a belief or assumption about the types of speech the proposed billboards would not include. *West Coast Media v. City of Gladstone*, 44 Or LUBA 503 (2003).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** An evidentiary proceeding before LUBA is not warranted to consider evidence that the petitioner has installed “light emitting diodes” on an existing sign in order to engage in constitutionally protected speech, where the question of whether petitioner’s installation is constitutionally protected speech is a legal conclusion, not an assertion of fact. *Meredith v. Lincoln County*, 44 Or LUBA 821 (2003).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** A city decision concluding that applying local sign ordinance criteria to deny a sign permit would violate Article I, section 8, of the Oregon Constitution is inadequate, where the findings do not identify what aspects of the local sign ordinance the city believes would be found to be unconstitutional or explain why the city believes it would be unconstitutional to apply the sign ordinance. *Haug v. City of Newberg*, 42 Or LUBA 411.

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** Where an application for city approval of a sign that is larger than allowed by city sign standards does not meet the city’s criteria for approval of such larger signs, a city may not cite constitutional concerns and approve the request for a larger sign without (1) adopting a reviewable decision that explains what constitutional provisions the city believes would be violated and why, and (2) explaining why the appropriate remedy in that circumstance would not be to deny the request until constitutional provisions for allowing such larger signs are adopted. *Haug v. City of Newberg*, 42 Or LUBA 411.

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** A zoning ordinance that lacks provisions governing signs and that is nevertheless applied to evaluate whether a proposed billboard is an accessory use to industrial and commercial uses allowed in the relevant zone is not subject to facial challenge under Article I, section 8 as an ordinance directed at the content of speech or as a content-neutral ordinance that expressly prohibits speech. *Media Art Company v. City of Gates*, 35 Or LUBA 123 (1998).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** A local government may constitutionally distinguish between signs related to on-premise uses, and signs related only to off-premise uses or services, and deny a proposed billboard because it is unrelated to the primary use of the property, where the city’s evaluation of the relationship between the sign and the premise does not entail a content-based distinction, and the on-premise/off-premise distinction is a rational means to preserve the zone for allowed uses. *Media Art Company v. City of Gates*, 35 Or LUBA 123 (1998).

**2.1.2 Constitutional Law – Oregon Constitution – Nonprocedural Issues.** A local government does not impermissibly favor commercial speech over noncommercial speech because it allows signs related to on-premise uses in an industrial and commercial zone and prohibits all others. That signs related to on-premise commercial uses are allowed while unrelated commercial and noncommercial signs are prohibited is an incidental consequence of the permissible distinction drawn between signs related to on- and off-premise uses. *Media Art Company v. City of Gates*, 35 Or LUBA 123 (1998).