

LED SIGNAGE RESEARCH AND INFORMATION

A compilation of various studies and articles
addressing LED signage

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A. Executive Overview

The Georgia Constitution grants to local government the authority over planning and zoning. Ga. Const. 1983, Art. IX, Sect. II, Para. IV. The traditional litmus test for the propriety and enforceability of planning and zoning laws is whether the law is substantially related to the public health, general welfare, safety, and morals. See, e.g., Gradous v. Board of Commissioners, 256 Ga. 469(1986); Barret v. Hamby, 235 Ga. 262 (1975). Within these parameters it is recognized that regulating on the basics of aesthetics is consistent with these basic guidelines. See, e.g., Warren v. City of Marietta, 249 Ga. 205 (1982).

In addition to contending with these parameters, sign regulation is also impacted by the constitutional protections afforded to speech. Under consideration is the City's current prohibition of "LED signs and similar technologies." *Code of Ordinances*, Sect. 20-51(22).¹ Such a content-neutral regulation must be "the least restrictive means of furthering the government's significant interests, while still leaving open ample alternatives to communicate." Grady v. Unified Government of Athens-Clarke County, 289 Ga. 726, 728 (2011).

Against this backdrop, LED signage presents unique challenges and issues for local governments with a growing body of literature indicating that LED signage has a negative impact on the public health, safety, and general welfare, including the aesthetics of a community. Examples of this literature are provided. Included within the body of literature presented in these materials are various compendiums describing and assessing a much larger volume of study in this area. While you are encouraged to review the materials in their detail in addition to this Executive Overview and Executive Summary of the materials provided, a few points emerge that are pertinent to the City's authority over planning and zoning.

The literature increasingly suggests that LED signage presents more potential for distraction from the driving task. This, in turn, increases the potential for accidents and near-accidents. Threatened thereby is the public's safety, health, and general welfare. As some of the studies captured in these materials show, there appears to be a correlation between such signage and increases in accidents and near-accidents. In addition, the literature gathered and commented upon reflects that such signage is not as environmentally friendly, presenting unique challenges in recycling and requiring/consuming more energy. LED signage can also have an adverse aesthetic impact that can be described (as do some of the studies) as "the Las Vegas effect."

¹ "LED sign shall mean an electronically controlled sign utilizing light-emitting diodes to form some or all of the sign message." *Code of Ordinances*, Sect. 20-3.

The research is still ongoing into the effects and impact of LED signage on driver distraction and other areas of potential impact. Contained in the materials are references to two studies underwritten by the outdoor sign industry where researchers concluded that LED signs had no measurable adverse impact on driver distraction in comparison with more traditional signage. As other materials captured here reflect, these studies have been largely panned for deficiencies in the methodology used and conclusions reached on what data has been released by the researchers. The same types of criticisms also have been leveled against a Federal Highway Administration study. Because the research is ongoing and, as some of the materials note, is very complex, a definitive set of guidelines for when, where, and how LED signage may be used, if possible at all, remains to yet be developed even by those who study in this field. Local government, however, is not required to wait for definitive rules or wait for a tragic event before regulating.

C. Executive Summary of Each Publication

1. *Compendium of Recent Research Studies on Distraction from Commercial Electronic Variable Message Signs (CEVMS)* (February 2016)

Summarizes various studies from around the world that have been conducted since 2008 and highlights the conclusions presented by those researchers and their studies. Then, synthesizing the information, the compendium highlights:

“Broadly summarized, the more recent studies have tended to find that outdoor advertising signs, particularly CEVMS, attract drivers’ attention, and that more dramatic and salient signs attract longer and more frequent glances. This attention is often captured through a “bottom up” physiological process, in which the driver attends to the sign unintentionally and unconsciously, with the eyes captured involuntarily by the sign’s changing imagery, brightness, conspicuity, and/or movement.

Several of the reported studies suggested that the distraction caused by outdoor advertising signs could be tolerated by experienced drivers and when attentional or cognitive demands of the driving task were low, but that the risk increased when such signs competed for the driver’s visual attention with more demanding road, traffic, and weather conditions, when travel speeds were higher, or when an unanticipated event or action (such as a sudden lane change or hard braking by a lead vehicle) occurred to which the driver had to respond quickly and correctly.

In addition, the more recent research continues to show that the drivers most susceptible to unsafe levels of distraction from roadside billboards are the young (who are more prone to distraction and less adept at emergency vehicle response) and the elderly (who have more difficulty with rapidly shifting attention, poorer night vision and glare susceptibility, and slower mental processing time). As will be seen in this Compendium, these concerns are heightened today, with our elderly driver population growing quickly, traffic increasingly dense, more roads under maintenance or repair (construction and work zones create added risks), and larger, brighter digital and video roadside advertising signs competing for the driver’s attention.

Finally, the most recent epidemiological studies (dating from 2014 and 2015) have begun to demonstrate what has long been suspected but not proven – that roadside billboards are associated with increases in crash rates where such billboards are located.

...

While employing a broad array of approaches and methodologies, the common theme clearly indicates that the more that commercial digital signs succeed in attracting the attention of motorists that render them a worthwhile investment for owners and advertisers, the more they represent a threat to safety along our busiest streets and highways, where these signs tend to be located.” (emphasis in original)

Author highlights some of the deficiencies and shortcomings of two principal studies relied upon by the outdoor sign industry and the fact that both studies received “overall negative reviews from peer-reviewers. Both studies were sponsored by the Outdoor Advertising Association of American and its research-arm, the Foundation for Outdoor Advertising Research and Education. Since these two studies were released, one group of researchers has continued to study the matter under industry auspices, but the industry has declined releasing the research data for peer review of the methodologies and conclusions.

2. *Digital Billboard Safety Amongst Motorists in Los Angeles* (Spring 2009)

The author undertook to study the impact of digital LED billboards on traffic safety. As part of the study the author briefly surveyed other studies, including studies that were critical of the methodologies and conclusions of industry-sponsored studies. The study undertaken concluded that digital LED billboards resulted in greater driver distraction than conventional static billboards and presented the following:

“Although evidence of several studies makes claims showing that there is no correlation between traffic collisions in environments with a digital billboard, most notably the two by the OAAA, there are others that prove legitimate increases in accidents, such as the WisDOT study. Therefore, this study cannot say with complete

confidence whether digital billboards contribute to the accident rate in any given area. As it was found in this study as well, what can be inferred is that drivers are more likely to glance at a digital billboards [sic] as opposed to a standard billboard ...; and the odds of a vehicular accident or near accident are twice as likely when a driver turns away from looking forward on the road for more than two seconds Although some studies show no correlation or are inconclusive between digital billboards and hazardous driving conditions, it is not sufficient to say that they are not detrimental to drivers because they do distract drivers and it should not rule out that they could cause a traffic accident. Nevertheless, no study has yet to show them to be safe.”

3. *Safety Impacts of the Emerging Digital Display Technology for Outdoor Advertising Signs – Final Report* (April 2009)

Undertook a comprehensive study of the then-existing literature associated with the technology, how the technology is used and deployed, and the stimuli impact on drivers and their reactions. The study notes that much more study is necessary to test any hypotheses on the relationship of the technology to driver distraction/inattentiveness and the correlating relationship, if any, on safety. The study also highlights the multitude of variables that are involved in such studies and the possibility that study methods have not yet caught up to the emerging digital technology. Though providing some recommendations for deployment of the technology, the author notes that it may be years before fully informed guidance and regulation can be provided to those whose job it is to adopt and enforce guidance and regulation. The study goes on to note:

“We now know that extended episodes (two seconds or longer) in which a driver’s eyes are not attending to the driving task greatly increases (by 3.7 times) the likelihood of a crash. ...Other researchers have suggested that the upper limit for an acceptable distraction episode may be 0.75 second ... or 1.6 seconds And, as shown ... in an onroad study, and by [another study], there is growing evidence that billboards can attract and hold a driver’s attention for the extended periods of time that we now know to be unsafe. As stated succinctly [in one of the studies] ... ‘drivers are comfortable turning their attention away from the road for a set period of time, regardless of the demands of the driving task’ And, [t]hese data ... indicate

that it is likely that our out-of-vehicle tasks (which not only engage attention but also draw the eyes and visual attention away from in front of the vehicle) would have quite significant detrimental effects on processing the roadway in front of the vehicle.’

We also have data to show, despite a lack of analysis by the researchers, that an on-road study ... using an instrumented vehicle found many more such long glances made to DBBs and similar ‘comparison sites’ consisting of (among other things) on-premise digital signs, than there were to sites containing traditional, static billboards, or sites with no obvious visual elements. Indeed, the mean values for these long glance durations proved to be significantly greater for the sites with digital signs than for the others. From the same study, we have evidence expressed by the researchers that if we were to conduct our research at night we would find that *all* measures of eye glance behavior would demonstrate significantly greater amounts of distraction to digital advertisements than to fixed billboards or to the natural roadside environment, and that driver vehicle control behaviors such as lane-keeping and speed maintenance would also suffer in the presence of these digital signs. Because the design of this study minimized the differences between the characteristics of DBB sites and the others, and did not report all of the pertinent data collected, it seems reasonable to believe that the differences found might be more pronounced in a more rigorous experiment.

When we add the results of these recent, applied research studies, to ... earlier theoretical work ..., in which was demonstrated that our attention and our eye gaze is reflexively drawn to an object of different luminance in the visual field, that this occurs even when we are engaged in a primary task, and regardless of whether we have any interest in this irrelevant stimulus, and that we may have no recollection of having been attracted to it, we have a growing, and consistent picture of the adverse impact of irrelevant, outside-the-vehicle distracters such as DBBs on driver performance.”

The study concludes that:

“those who think that their job is to do what they can to enhance safety for the traveling public based upon the best available

information, now have, in our opinion, access to a strong and growing body of evidence, including evidence from industry supported research, that roadside digital advertising, attract drivers' eyes away from the road for extended, demonstrably unsafe periods of time.”

4. *Electronic Billboards and Highway Safety* (May 2003)

This is a report prepared for the Wisconsin Department of Transportation. It surveys and summarizes various studies and research papers concerning driver distraction and electronic signage. The study notes that “[c]ommercial EBBs [electronic billboards] are designed to ‘catch the eye of drivers[,]’ and notes that “[t]he consequences of distraction from the driving task can be profound.” (Page 5) The report went on to highlight several studies including:

- A 1976 study of crashes at a major artery intersection of on-ramps, off-ramps and other signage where an electronic sign was erected, concluding that the electronic sign was a distraction and a safety risk.
- A 2001 study of crashes finding that driver distraction was a cause of approximately 13% of the crashes studied with the largest segment of these crashes caused by distractions outside the vehicle.

5. *Evaluation of the Visual Demands of Digital Billboards Using a Hybrid Driving Simulator* (2014)

A study was conducted of driver eye behavior and corresponding impact on driving while driving at 25mph and 50mph on a simulated straight roadway and exposed to digital billboards viewed in a drive-like progression with messages of varying lengths/characters. The study participants were college students averaging 22 years of age with visual acuity no worse than 20/28. So, not studied were: older drivers, including the elderly; those with poorer vision; and behavior where the road was not a straight line for the drive. The “[r]esults indicated that drivers gradually drift away from the centerline during the [digital billboard] inspection interval, and then execute large/sudden compensatory steering inputs to re-establish their position in the center of the lane after the billboard had been overtaken.” The study found that the more characters/words/images presented by the sign, the more pronounced was ineffective lane control.

6. *Abstract of Investigation of the Potential Relationship Between Crash Occurrence and the Presence of Digital Advertising Billboards in Alabama and Florida* (2015)

Study examined historical crash data in Alabama and Florida adjacent to site locations where digital billboards existed. “The crash data analyses revealed that the presence of digital billboards increased the overall crash rates at digital advertising billboard influence zones by 25% in Florida and 29% in Alabama compared to control sites.”

7. March 4, 2016 article from insurancenewsnet.com regarding a field study by the Massachusetts Institute of Technology on the effects of digital billboards on glance behavior during highway driving.

The article quotes the report as stating that:

“Decades of laboratory research have shown that rapidly changing or moving stimuli presented in peripheral vision tends to ‘capture’ covert attention.”

According to the article the MIT report concludes:

“Since rapidly changing stimuli are difficult to ignore, the planned increase in episodically changing digital displays near the roadway may be argued to be a potential safety concern.”

8. *Federal Highway Administration study confirms safety of digital billboards and signs* (June 16, 2014; www.digitalsignagetoday.com)

Article published in sign industry publication touting industry-favorable conclusions from a Federal Highway Administration study examining the impact of digital signage on safety.

9. *A Critical, Comprehensive Review of Two Studies Recently Released by the Outdoor Advertising Association of America* (October 2007)

This report was prepared for the Maryland State Highway Administration in light of the OAAA having declared that the occurrence of traffic accidents was unaffected by the presence of digital/electronic billboards. The study found that the studies touted by the OAAA (and sponsored by it) used flawed methodologies and assumptions and that even the researcher’s own information and materials belied the conclusion that the billboards did not pose a traffic threat. The report did so by painstakingly reviewing and evaluating critical aspects of the studies’ analyses.

Unlike many other studies referenced in the materials compiled here, neither of the studies touted by the OAAA were peer-reviewed prior to being issued. The report concluded that:

“[h]aving completed this peer review, it is our opinion that acceptance of these reports as valid is inappropriate and unsupported by scientific data, and that ordinance or code changes based on their findings are ill-advised.”

10. *Highway Agency Takes a Hit Over Safety Report on Electronic Billboards* (Feb. 9, 2015; www.fairwarning.org)

Article regarding a critique of the FHWA study touted by the outdoor advertising industry that highlighted some of the major criticisms and perceived deficiencies in the study.

11. *Billboards in the Digital Age Unsafe (and Unsightly) at Any Speed* (Scenic America Issue Alert 2 (2007): 1-8 (Mar. 30, 2009))

Overview of the problems and concerns posed by digital signage and commenting on how the use of LED signage presents a new source of blight in a community. The article goes on to note that:

- Electronic signage is extremely bright so it can be visible in the daylight and at night, drawing a driver’s attention more strongly. This means it also stands out from a greater distance than traditional signage meaning that it can become distracting even before the message is visible. Digital signs are often the brightest object in the landscape, especially at night.
- The changing content of an electronic sign attracts the driver’s attention as the driver is trying to determine what the next message is or will be.
- The Florida Department of Transportation states that it takes six seconds to comprehend the message on an electronic billboard which is three-times longer than what studies find to be safe.
- Younger drivers may be more easily distracted and older drivers may require a longer viewing time for comprehension.

12. *Citizens for a Scenic Florida Report* (Obie Media Corporation)

The report summarizes expert witness opinion finding that the amount of time needed by drivers to view a billboard is as long as eight seconds. During that time, drivers' attention is focused away from the roadway. An automobile would travel between 470 feet and 800 feet during the interval it takes to read the sign. Notes that driver attention is particularly important at high speeds, at intersections, and interchanges.

13. *Milwaukee County Stadium Variable Message Sign Study: Impacts of an Advertising Variable Message Sign on Freeway Traffic* (Wisconsin Dept. of Transportation, Dec. 1994)

A six-year analysis was performed starting three years before a variable message sign was erected at Milwaukee County Stadium and continuing over the next three years. The results of the study indicated a substantial increase in both side-swipe and rear-end collisions in the lane from which the sign was most visible. Both types of collisions together resulted in a 43% increase in accidents the year of installation and a 36% increase in collisions over the next three years.

14. *The Impact of Driver Inattention on Near-Crash/Crash Risk: An Analysis Using the 100 Car Naturalistic Driving Study Data, Executive Summary* (U.S. Dept. of Transportation, National Highway Traffic Safety Administration, April, 2006)

This study included a number of driver inattention tasks and conditions. The analysis of eye-glance behavior indicated that total eyes-off-road durations of greater than two seconds significantly increased individual near-crash/crash risk whereas eye-glance durations of less than two seconds did not significantly increase risk relative to normal, baseline driving.

15. *Illuminating the Issues – Digital Signage and Philadelphia's Green Future*
(www.scenic.org/storage/documents/Digital_Signage_Final_Dec_14_2010/pdf)

Highlights the environmental impact and concerns of the use of digital signage. Generally, such signage consumes more energy to light and maintain than conventional signage because more lamps are used to present the light and digital signage requires auxiliary equipment that consumes energy (e.g., fans to cool the sign and electrical equipment controlling the display). Certain specific findings include:

- LED signs generate heat and do not function well in the heat, thus requiring a cooling system to preserve the unit's useful life.
- An LED billboard measuring 672 square feet uses "about 46 times the power ... of a typical billboard lit by four halide lamps. ... It's almost 30 times the energy used in the average U.S. home."
- Digital signage can result in light trespass and light pollution, noting that to capture the driver's attention digital signs must be set at a very high brightness level because it competes with the sun. Also, the brighter the sign, the more energy that is required and used.
- LED signs have a lifespan of approximately eleven years in contrast to the fifteen years of a traditional sign, meaning that LED signs will be replaced more frequently. This creates a potential waste disposal challenge because the equipment is difficult to recycle.
- Notes that some cities and states have banned electronic signs successfully.

16. *Signs, Billboards and Your Community – A citizen's manual for improving the roadside environment by effective control of billboards and outdoor advertising* (Pennsylvania Resources Council, Inc. and Society Created to Reduce Urban Blight)

The report highlights that:

- "[t]he visual identity of a community creates a sense of place and civic pride. A community is strengthened when people have positive attitudes toward it, and the visual environment can strongly affect those attitudes. Poorly controlled outdoor advertising can foster a sense of blight and reduce one's sense of community character, to the detriment of civic pride."
- "Experienced drivers learn to ignore features such as signage along roadways that they travel frequently. The outdoor advertising industry refers to the driver's learned behavior ignoring signs as 'site fatigue.' The advertiser is then put in the position of either having its message ignored or having to frequently rotate message and put up more eye-catching advertisement to draw driver's attention back away from the road."

- Public health issues are discussed, including the individual's inability to control his or her visual field, the unintended saturation of messages to children, and the contribution of visual clutter to blight and stress.

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AN ORDINANCE OF THE CITY OF DUNWOODY, GEORGIA ADDRESSING AND PROHIBITING LED SIGNAGE; RECOGNIZING THE VARIOUS CONCERNS PRESENTED BY SUCH SIGNAGE AND THE IMPACT OF THOSE CONCERNS ON THE PUBLIC SAFETY, HEALTH, AND GENERAL WELFARE, INCLUDING AESTHETICS; TO REPEAL RESOLUTION 2016-__-__ THAT IMPOSED A 90-DAY MORATORIUM ON ACCEPTANCE OF NEW SIGN PERMITS AND VARIANCE APPLICATIONS FOR LED SIGNS; TO PROVIDE FOR SEVERABILITY; TO ESTABLISH AN EFFECTIVE DATE; AND FOR OTHER PURPOSES.

WHEREAS, Article IX, Section II, Paragraph IV of the Constitution of the State of Georgia confers on the City the authority to plan and zone; and

WHEREAS, pursuant to that delegation of authority the City of Dunwoody, Georgia ("City") regulates signage within its City limits in Chapter 20 of the City's Code of Ordinances ("Sign Ordinance") for purposes of protecting the public health, safety and general welfare as well as for preserving the unique aesthetics of the City; and

WHEREAS, the Section 20-51(22) of the Sign Ordinance prohibits "LED signs and similar type technologies" and defines "LED signs" in Section 20-3 of the Sign Ordinance; and

WHEREAS, the Mayor and Council have recently been notified of certain concerns that the City's prohibition on LED signs may be invalid; and

WHEREAS, the City was also recently involved in litigation challenging the enforceability of the City's prohibition on LED signage for which a disposition, had it been adverse to the City, may have exposed the City to having to permit signage it may nevertheless lawfully regulate; and

WHEREAS, the City authorized a limited review of the City's Sign Ordinance and preparation of any revisions to be considered addressing certain concerns raised about the Sign Ordinance's prohibition of LED signs; and

WHEREAS, as a part of that process the City adopted Resolution 2016-__-__ imposing a 90-day moratorium on accepting new sign permit and variance applications for LED signs while the limited review was conducted because accepting same would have undermined the policy goals of the City and present long-lasting conflicts with those policies; and

WHEREAS, the limited review has been completed and materials generated by that review have been submitted to the City, including the Planning Commission and the Mayor and Council; and

WHEREAS, in accordance with the City's Code of Ordinances a public hearing was held by the Planning Commission on April 12, 2016 to consider

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whether or not the City's prohibition on LED signage should remain in place or be repealed or modified in any way at which time the materials provided and associated issues were presented, discussed, and evaluated; and

WHEREAS, upon considering all that was provided to and considered by the Planning Commission, it recommended that the City's prohibition on LED signage continue; and

WHEREAS, the recommendation of the Planning Commission and the record developed before it was provided to the Mayor and Council in anticipation of a public hearing before the Mayor and Council to consider whether or not the City's prohibition on LED signage should continue or be repealed or modified; and

WHEREAS, in accordance with the City's Code of Ordinances a properly noticed public hearing was held by the Mayor and Council on _____ to consider whether or not the City's prohibition on LED signage should remain or be repealed or modified at which time the materials generated by the limited review as well as the record of proceedings before the Planning Commission were provided and associated issues were presented, discussed, and evaluated; and

WHEREAS, the Mayor and Council, having reviewed the materials provided and having considered the record of this matter as a whole, finds and concludes that demonstrated is a substantial and serious adverse impact by LED signage on driver distraction that, in turn, presents the same for traffic safety and the corresponding safety of the traveling public and property; and

WHEREAS, a prohibition on LED signage will serve as a means of managing traffic control in the City, a goal expressed in the City's current Comprehensive Plan adopted in October 2015; and

WHEREAS, the Mayor and Council, having reviewed the materials provided and having considered the record of this matter as a whole, finds and concludes that demonstrated are substantial and serious concerns about the environmental impact of such signage, including, but not limited to, its energy use and consumption and the recyclability of such signage when use is discontinued and ease of same; and

WHEREAS, a prohibition on LED signage will serve the goals expressed in the City's Comprehensive Plan of preserving the existing character of the City; and

WHEREAS, a prohibition on LED signage is consistent with the City's 2014 Sustainability Plan and its focus on resource conservation and waste reduction; and

WHEREAS, the Mayor and Council, having reviewed the materials provided and having considered the record of this matter as a whole, and in light of the foregoing especially, finds and concludes that the current prohibition on LED signage in the City should be continued, the public safety, health, and general welfare, including aesthetics being served substantially by same; and

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WHEREAS, the Mayor and Council, having reviewed the materials provided and having considered the record of this matter as a whole concludes that based on the materials and record before it, a prohibition on LED signage is the least restrictive manner of preserving the public safety, health, and general welfare, including aesthetics; and

WHEREAS, the Mayor and Council, having reviewed the materials provided and having considered the record of this matter as a whole concludes that a host of other signage avenues yet remain available for the communication of commercial and non-commercial speech.

NOW, THEREFORE, BE IT ORDAINED by the Mayor and Council of City of Dunwoody, Georgia as follows:

SECTION 1. The current prohibition on LED signage contained in Chapter 20 of the City's Code of Ordinances at Section 20-51(22) shall be preserved and continued.

SECTION 2. Resolution 2016-__-__ is repealed in its entirety.

SECTION 3. All ordinances and resolutions, or parts of same, in conflict with this Ordinance are, to the extent of such conflict, hereby repealed.

SECTION 4. In the event a court of competent jurisdiction declares any word, phrase, clause, sentence or paragraph of this Ordinance unconstitutional or otherwise unenforceable, such ruling shall not affect the remaining words, phrases, clauses, sentences and paragraphs of this Ordinance, but such invalidated provisions shall be severed from the Ordinance and its remaining contents shall stand.

SECTION 5. This Ordinance shall be effective upon its adoption by the Mayor and Council.

SO ORDAINED BY THE MAYOR AND COUNCIL OF THE CITY OF DUNWOODY, GEORGIA on the ___ day of _____, 2016.

Approved by:

Denis L. Shortal, Mayor

Attest:

Approved as to Form and Content:

Sharon Lowery, City Clerk

City Attorney

DRAFT