

EXHIBIT H
APPLICANT-SUPPLIED FINDINGS



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May 6, 2019¹

VIA EMAIL AND FEDERAL EXPRESS

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Re: Letter requesting height variance for Outfront Media's proposed digital outdoor advertising display on Highway 41

Dear Ms. Merrill and Mr. Olsen:

As you know, Miller Starr Regalia represents Outfront Media LLC ("Outfront") in seeking land use entitlements to construct and operate three digital billboards on City-owned land in the City of Fresno. This proposal is the realization of a process that began in 2015, when the City issued a request for proposals to "operate two-sided digital billboards on city-owned sites located along freeways and major traffic corridors." (City RFP No. 9352.) This municipal project also contemplated the removal of ten existing, static billboards in an effort to beautify the City's thoroughfares. Ultimately, the City selected Outfront to implement the project, which led the parties to sign a master lease for the City-owned sites, dated August 25, 2016, which memorialized Outfront's obligations. As planned, these obligations include the removal of existing sign inventory and the dedication of advertising time for City programs.

Outfront proposes to construct one of the new signs at a height of 86 feet above grade, whereas the City's zoning ordinances ordinarily limit the height of signs to 60 feet. (Fresno Municipal Code § 15-303, Table 15-1303-2.) Accordingly, this letter outlines the justification for a height variance for this sign, which would be located between North Howard Street and State Highway 41 in the City (the "Sign"), and would be primarily visible to motorists traveling on Highway 41.

Here, Outfront is seeking a variance because the base of the Sign would be located approximately 21 to 26 feet below the grade of Highway 41, and because other

¹ This letter is intended to supersede a variance request letter sent by Miller Starr Regalia on April 24, 2019.

existing vegetation and infrastructure, including telecommunication towers and street lighting, would impede visibility of a shorter sign. As various visual simulations make clear, any sign less than 86 feet tall would not be marketable, as one of the telecommunication towers would bisect the display's advertising copy. Please see the following visual simulations, discussed in more detail below.



66' Sign

Sign unacceptably
bisected by cell
tower



86' Sign

Ad copy on Sign
acceptably
clears cell tower

For ease of viewing, we have enlarged the sign simulations to better illustrate the obstructions:



66' Sign



86' Sign

The 66-foot sign simply cannot be sold to advertisers, since any posted advertising copy would be difficult to read. Meanwhile, the 86-foot sign is fully marketable, as the display's copy acceptably clears the cell tower — a determination that is based on Outfront's decades of experience operating digital outdoor advertising displays.

Finally, as is also outlined below, construction and operation of the Sign qualifies for an exemption from environmental review under the California Environmental Quality Act and, in particular, a Class 3 CEQA exemption.

I. Location of the Proposed Sign and Surrounding Uses

The Property where Outfront Proposes to locate the Sign is City-owned property described as APN No. 303-201-33, located immediately north of 7161 North Howard Street (the “Property”). The Property is located between North Howard Street and State Highway 41, and is zoned for commercial office use. The height of structures in office zones are limited to 60 feet. (Fresno Municipal Code § 15-303, Table 15-1303-2.) Similar office uses lie to the east, whereas property zoned for commercial regional uses lie to the west. Please see **Figure 1**, which shows the location of the Sign and zoning of nearby parcels.

Figure 1.



The Sign would be located on the southwest portion of the Property, with a 72-foot telecommunications tower located directly to the north, and a 112-foot telecommunications tower located to the east. The base of the Sign would be situated approximately 345 above sea level, and its two displays, measuring 14-feet by 48-feet, would face northbound and southbound traffic on Highway 41. The elevation of Highway 41, meanwhile, is approximately 366 to 371 feet above sea level. **Figure 2**, below, consists of satellite imagery showing the location of the Sign

and its surrounding land uses, and **Figure 3** depicts the Sign's elevation in graphic form.

Figure 2.

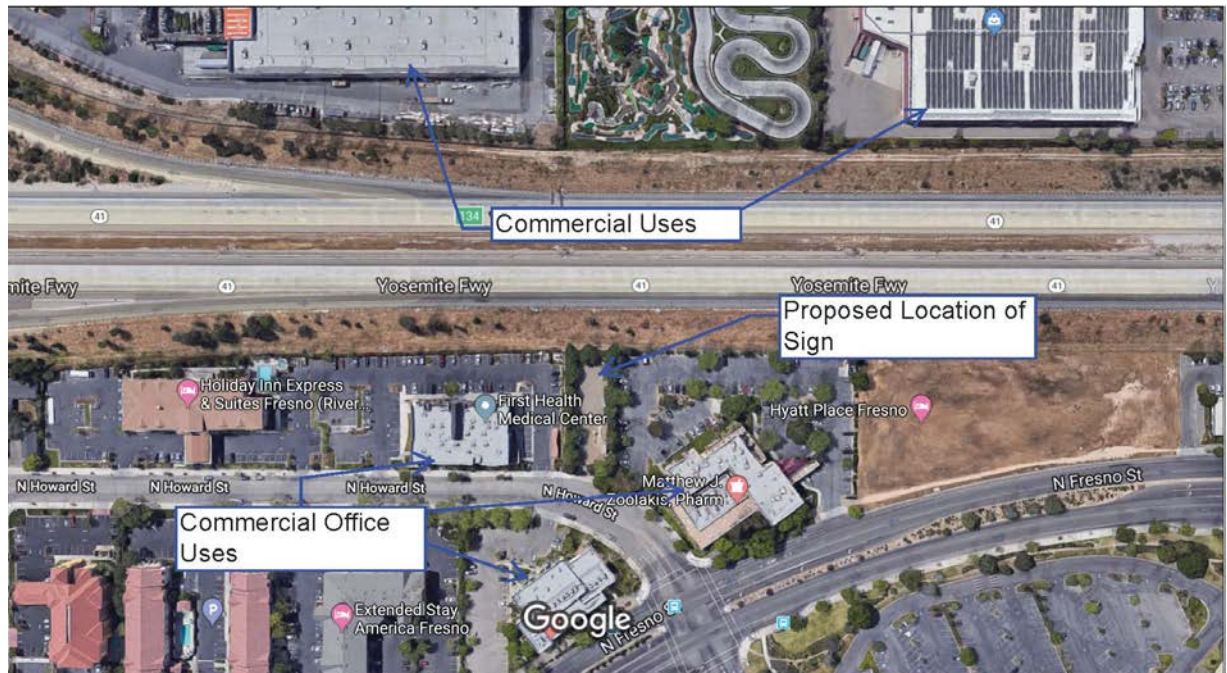
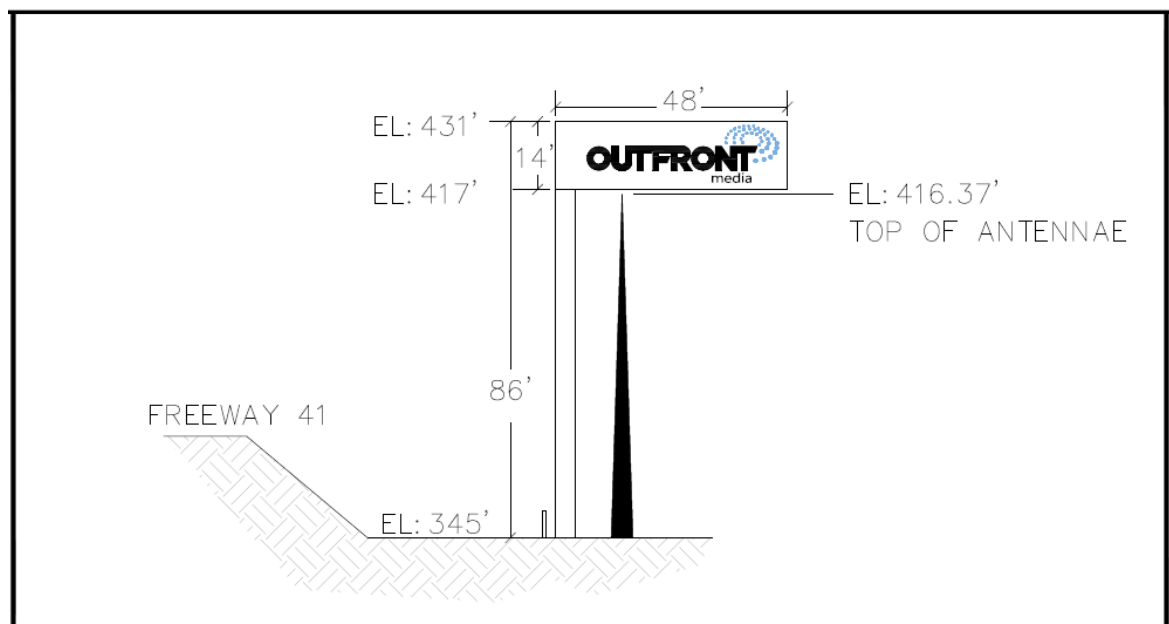


Figure 3.



II. Substantial Evidence Supports the Findings Necessary for a Variance

To issue a variance, the City must make certain findings under Fresno Municipal Code section 15-5506, which provides:

A variance... shall only be granted if the [City] determines that the project as submitted... conforms to all of the following criteria:

- A. There are exceptional or extraordinary circumstances or conditions applicable to the property involved that do not apply generally to property in the vicinity and identical zoning classification, and that the granting of a Variance will not constitute a granting of a special privilege inconsistent with the limitations on the property in the vicinity and identical zone classifications;
- B. The granting of the application is necessary to prevent a physical hardship which is not of the applicant's own actions or the actions of a predecessor in interest;
- C. The granting of the application will not be detrimental or injurious to property or improvements in the vicinity, and will not be detrimental to the public health, safety, general welfare, or convenience, nor the preservation and conservation of open space lands; and
- D. The granting of the Variance will be consistent with the general purposes and objectives of this Code, any applicable operative plan, and of the General Plan.

Under present circumstances, the City may make the foregoing findings based on substantial evidence. A discussion of this evidence follows.

A. *Finding 1: There are Exceptional Circumstances Justifying Issuance of a Variance*

Pursuant to section 15-5506(A) there “are exceptional or extraordinary circumstances or conditions applicable to the property involved that do not apply generally to property in the vicinity and identical zoning classification, and that the granting of a Variance will not constitute a granting of a special privilege inconsistent with the limitations on the property in the vicinity and identical zone classifications.”

The Sign satisfies this criterion. First, the Sign's location, with an elevation of 21 to 26 feet below the grade of the Highway 41, means that a billboard sign at the permitted height of 60 feet would stand approximately 34 to 40 feet above the highway. Such a sign, when compared to a 60-foot highway sign with less

challenging topography, would be less visible, and obstructed significantly more by highway-grade vegetation and other obstacles. Meanwhile, the location of the Sign on the City's Property is located among a number of other, tall structures, including two telecommunication towers and highway street lights. Additional height is necessary so that the Sign is noticeable and readable to motorists of normal visual acuity. **Figures 4-8**, below, depict the roadside trees, shrubs, telecommunication towers, and highway lighting that crowd the Property, and which would occlude visibility of a shorter sign.

Visual simulations, comparing Sign heights at 60 feet, 66 feet, and 86 feet,² are also included in this letter as **Simulations A, B, C and D**, and attached to this letter as **Attachment A**. The following is noted with respect to the simulations:

- ***Simulations A-1 to A-4, Southbound Views.*** Based on the southbound-view simulations alone, an 86-foot sign is the only viable alternative. A 66-foot and a 60-foot sign would have a telecommunications tower bisecting the digital copy on the signs' facings. From a marketability standpoint, operation of such a sign is infeasible, as Outfront could not sell advertising space on such a sign. This determination is based on decades of experience the company has, marketing space on outdoor advertising displays across the nation. From a common sense standpoint, we ask the decisionmakers to consider whether they have ever seen a billboard with advertising space wholly bisected by a telecommunications tower or other structure. The 86-foot alternative, meanwhile, would be marketable (if it were not marketable at 86 feet, Outfront would not be proposing this project).
- ***Simulations B, C, and D, Northbound Views.***³
 - o *Simulations B-1 to B-4:* These simulations show the 86-foot sign clearing the top of the tallest tree in the area, whereas the 60-foot and 66-foot signs are blocked by this vegetation.
 - o *Simulations C and D:* These "wire-frame" simulations show, from other vantage points, the vertical footprint of an 86-foot sign and

² These heights were selected so the City could compare the heights of the Sign at the maximum, permitted level (60 feet), the level allowed under a minor deviation to height limits (66 feet), and at the requested height requiring a variance (86 feet).

³ The previous northbound-view simulations, attached to our April 24, 2019 letter, involved a vantage point from an on-ramp, where mature vegetation was prominently in the foreground, and where motorists would be more focused on merging than on signage. Simulations B, C, and D, by contrast, involve vantage points from main traveled ways, which is where the sign's target audience will be positioned

66-sign. The photos of Highway 41 that serve as the foundation of these simulations were taken from different distances and main traveled lanes, and show the same as Simulations B-1 to B-4: that is, an 86-foot sign would escape occlusion by vegetation, whereas a shorter sign is obstructed.

In many cases it is possible to trim trees, but in Outfront's experience, trimming the roadside vegetation to make the shorter 60-foot or 66-foot signs more visible would involve at least topping the relevant trees, which is disallowed, because doing such can cause a tree to fail. The 86-foot sign would not require any trimming but, even if it did, trimming could be conducted in a manner which did not endanger any trees.

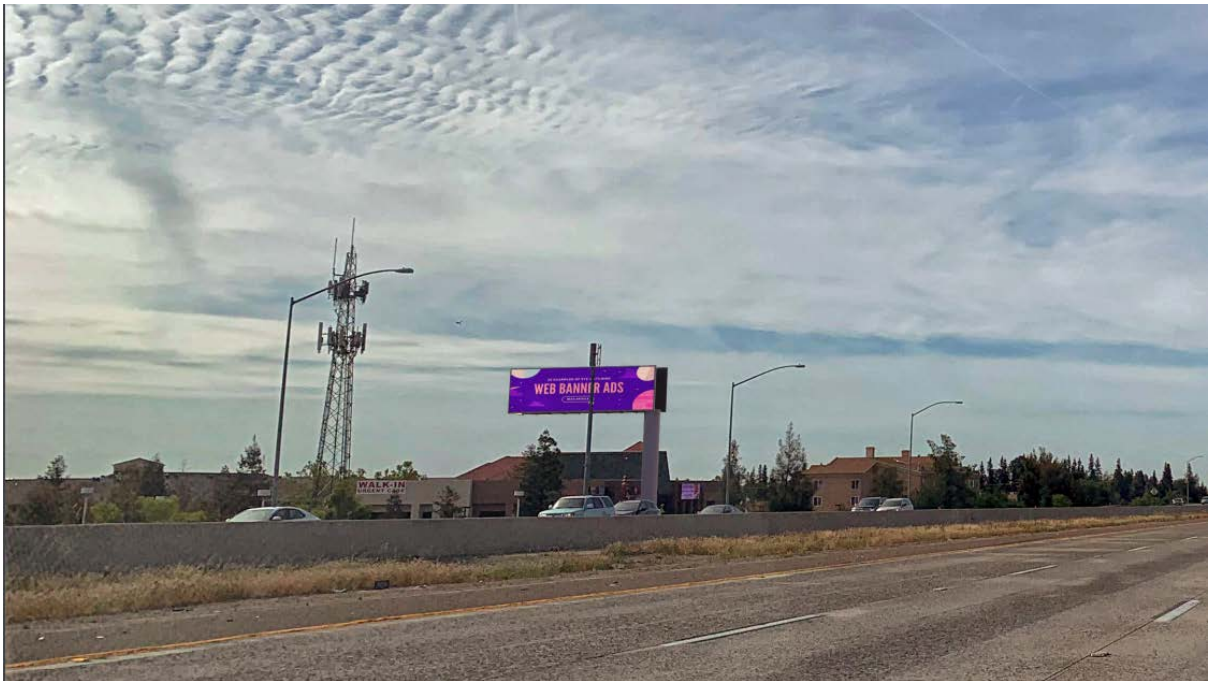
Simulation A-1. Project site from Hwy 41 southbound lane, existing view



Simulation A-2. Project site from Hwy 41 southbound lane, 60' sign



Simulation A-3. Project site from Hwy 41 southbound lane, 66' sign



Simulation A-4. Project site from Hwy 41 southbound lane, 86' sign



Simulation B-1. Project site from Hwy 41 northbound lane, existing view



Simulation B-2. Project site from Hwy 41 northbound lane, 60' sign



Simulation B-3. Project site from Hwy 41 northbound lane, 66' sign



Simulation B-4. Project site from Hwy 41 northbound lane, 86' sign



Simulation C. Project site from Hwy 41 northbound lane, alt. view, 86' v. 66' sign



Simulation D. Project site from Hwy 41 northbound lane, alt. view, 86' v. 66' sign



Figure 4.



Figure 5.



Figure 6.



Figure 7.



Figure 8.



The height of an outdoor advertising display is a key factor in valuing its effectiveness. As one industry publication notes:

Since people need the opportunity to see the message for it to be effective, a very important factor in billboard value is approach visibility ...The approach should have as few visual obstructions “moving through” the read.

...

Obstructions to a clear view frustrate billboard owners. If a sign cannot be seen easily in a sustained clear view, advertisers will have less interest in that billboard.

...

... background landscape can affect the attention that is paid to a billboard. If a sign is located low and along distance from the roadway on the left hand side ... motorists may not be paying much attention to the billboard

...

Possibly the most critical feature of the approach to a sign is the amount of time motorists have to read the message.

...

... the best billboards are those where the viewer has nothing else to notice. The less competition for attention the better. Competition for attention can come in many forms including buildings, business signs, other billboards, stadiums, scenic views, roadway information signs,

merging lanes of traffic and many others The idea sign stands alone, while the least desirable location is in a jungle of signs and distractions.

...

In order for an advertisement to be effective, it must be seen clearly.

(Billboard Appraisal: The valuation of Off-Premise Advertising Signs, American Society of Appraisers, Paul Wright and Jeffrey Wright, at 150-51,157.)

Again, at a lower height, the Sign would become lost in a “jungle” of infrastructure. At a taller height, it would be easier for motorists to see the Sign because they would not need to search it out among lights, trees, and telecommunication towers that they otherwise would ignore. Indeed, with a taller sign that stands at 86 feet, motorists would continue to ignore the more low-lying trees, lights, and other obstacles and, accordingly, a taller Sign would in fact be the safer alternative.

Finally, there are other properties located in similar zones that have the same elevation as Highway 41 (or even more favorable topography), and are not crowded by taller structures. For instance, the 6100 block of North Thesta Avenue (north of East Bullard Avenue, adjacent to Highway 41), which consists of properties zoned for commercial office uses, sits at an elevation *above* Highway 41 by as much as 20 or 30 feet, and therefore any proposed sign at these properties would be extremely visible to passing motorists.

Meanwhile, there are other, existing signs in nearby commercial business zones that do not suffer from the same exceptional circumstances and conditions that affect the Property. For instance, a relatively short distance south on the Highway 41 corridor, at 2055 E. Shields Avenue, an electronic sign that displays on- and off-premise advertising copy operates at a significant height, and has neither competing structures nearby nor a significant grade difference when compared to Highway 41. This sign is shown in **Figures 9-10**. Elsewhere, the City’s highways are replete with tall on- and off-premise signage at or near 60 feet tall, with relatively empty skylines and on properties with elevations near that of the adjacent highway segments. See **Figures 10-12** [showing signs at 2701 E. Byrd Avenue and 2712 S. 4th Street].)

In summary, the Sign’s location, which involves a property that is 21 to 26 feet below the adjacent highway grade, and which accommodates telecommunications towers and sits amid other tall obstructions, constitutes extraordinary and exceptional circumstances that other property owners in the vicinity do not face. The grant of a variance therefore would not constitute the grant of a special privilege that is inconsistent with the limitations on nearby commercial property owners.

For the foregoing reasons, substantial evidence supports a finding that Outfront’s variance application would meet the requirements of City Ordinance Code section 15-5506(A).

Figure 9. Digital sign at 2055 E. Shields Ave., from southbound lanes of Hwy 41



Figure 10. Digital sign at 2055 E. Shields Ave., from northbound lanes of Hwy 41

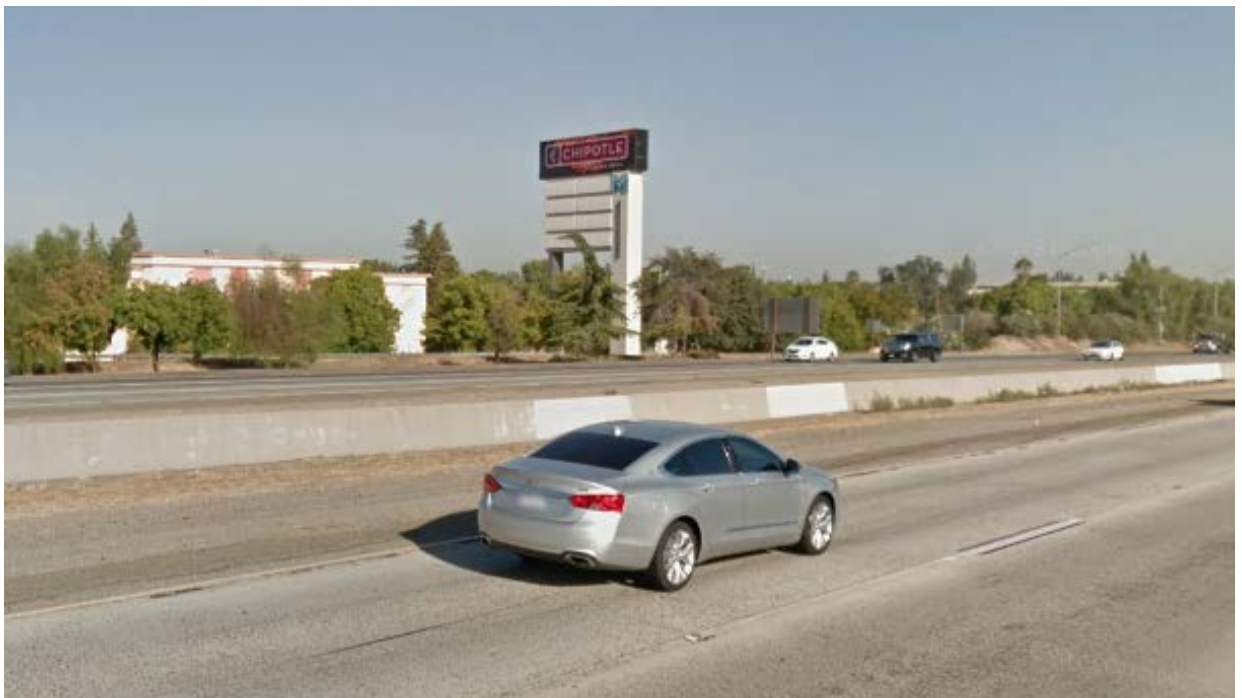


Figure 11. Tall on-premise advertising sign at 2701 E. Byrd Ave., by Hwy 99



Figure 12. Tall on-premise advertising sign at 2712 Fourth St., by Hwy 99



B. *Finding 2: The Granting of the Variance Application is Necessary to Prevent a Physical Hardship that is not the Result of Outfront's Actions or its Predecessor in Interest.*

Pursuant to section 15-5506(B) of the Municipal Code, the “granting of the application is necessary to prevent a physical hardship which is not of the applicant's own actions or the actions of a predecessor in interest.”

As illustrated above, if a variance is not granted, and Outfront is required to construct the Sign at a height at or below 86 feet, the Sign will be physically obstructed by highway-grade objects and nearby towers. This will cause a physical hardship that directly interferes with Outfront's property interests and revenues from the Sign. This hardship would be significant, and likely would make the project financially infeasible.

The operation of an advertising sign is a substantial property right, and courts have held billboards and billboard permits constitute protectable property interests under the federal Constitution. (*Traverso v. People ex rel. Dept. of Transp.* (1993) 6 Cal.4th 1152.) In determining that billboards qualify as a protectable interest, the California Supreme Court held the value of displays “derives primarily from their use as an advertising medium,” and it was “un-contradicted that a single billboard can generate several thousands of dollars per month in advertising revenues.” (*Id.*) Moreover, the structure itself has pecuniary worth. (*Id.*) Key to operating a profitable sign is that it be plainly visible to a motorist or passenger of normal visible acuity, and the circumstances here that limit the visibility of shorter signs is not attributable to Outfront. Outfront did not, for instance, construct Highway 41 at its present, elevated grade, nor plant or construct the various objects that would obstruct a 60-foot sign on the Property.

For the foregoing reasons, substantial evidence supports a finding that Outfront's variance application would meet the requirements of City Ordinance Code section 15-5506(B).

C. *Finding 3: The granting of a variance will not be detrimental to property or public health or welfare in the vicinity.*

Pursuant to section 15-5506(C), “the granting of the application will not be detrimental or injurious to property or improvements in the vicinity, and will not be detrimental to the public health, safety, general welfare, or convenience, nor the preservation and conservation of open space lands.”

First, the Sign will be located in an area that is not particularly sensitive, and is suitable to Outfront's proposed use. The Sign would be located immediately adjacent to utility structures, including two already existing telecommunication towers that are similar or greater in height. Moreover, uses adjacent to the Property include large scale commercial office facilities to the east, Highway 41 to the west, and large-scale commercial uses located west of Highway 41. Overall, the Property

sits within a fully urbanized area that is visually dominated by commercial land uses and surface-street features.

Under separate cover, Outfront has provided detailed information showing that light generated by the Sign's LED facings will not increase ambient light beyond approximately 250 feet. (See March 19, 2019 Miller Starr Letter to the Fresno County Airport Land Use Commission ["Lighting Parameters Letter."].) Outfront will achieve this limit on light pollution by designing the Sign to: (1) comply with brightness requirements of the Outdoor Advertising Act and other state law, and in fact Outfront will operate the Sign at a brightness level that is one-fifth the state's permitted maximum (e.g., Bus. & Profs. Code, § 5403; Vehicle Code, § 214466.5); (2) comply with guidelines set forth by the Outdoor Advertising Association of America ("OAAA") that ensure lighting levels will not exceed 0.3 foot-candles over ambient levels at certain distances; and (3) incorporate technology that adjusts the brightness of the Sign. For convenience, we have attached this correspondence, and incorporate it herein by this reference. (See Lighting Parameter Letter.) **Attachment B.**) These lighting levels are also below City levels, as discussed in the next section. We note, too, that there are no sensitive receptors within 250 feet of the Sign.

Second, the intended use of the Property would inure to the direct benefit of the City and the public. The construction of the Sign near the City's northerly boundary would provide the City with a mechanism to advertise municipal services and events near a City gateway, as the Sign would be subject to an agreement with the City reserving certain advertising space for public service announcements.

In conclusion, the Property is not located in a sensitive area. Also, given the parameters under which Outfront will operate the Sign, the project would not be detrimental to property or improvements in the vicinity, and would not be detrimental to the public health, safety, general welfare, or convenience, nor the preservation and conservation of open space lands.

D. *Finding 4: The granting of the variance will be consistent with the general purposes and objectives of this Code, any applicable operative plan, and of the General Plan*

Pursuant to section 15-5506(D) of the municipal code, the granting of a variance application must contemplate a project that is consistent with the general purposes and objectives of the City's code, any applicable, operative plan, and the City's General Plan.

With regard to outdoor advertising signs, the Fresno Municipal Code allows for "agreements to relocate presently existing, legal billboards, pursuant to Business and Professions Code Section 5412." (Fresno Municipal Code § 15-2605.) In such an agreement, "[t]he new billboards which replace existing billboards may be located on City-owned property and may feature electronic copy, at the discretion

of the City Manager” and that “[r]eplacement billboards shall comply with all applicable federal, State, and local regulations.” (*Id.*) As the City knows, the digital signs that are contemplated in the master lease agreement, including the Sign, are not only subject to removal under the City’s master lease (which was approved and executed by the City Manager), but are also subject to a state eminent domain action. This action has sought the removal of existing Outfront signs to make way for the state’s High Speed Rail Project, and thus the instant relocation deal allows the state to avoid the payment of just compensation to Outfront, in compliance with section 5412 of the Outdoor Advertising Act. It also allows the City, under section 5412, to ensure removal of this sign inventory for its own roadway beautification purposes without having to pay Outfront just compensation.

In terms of development standards, and consistent with relocation provisions in section 15-2605 of the Fresno Municipal Code, the City set forth the specifications for the Sign in its Request for Proposals and the master lease, requiring the displays be limited to 14-feet by 48-feet, and that any digital displays be spaced no closer than 1,000 feet to another such display. (City RFP No. 9352; Master Lease § 1(k), 5(c).)

Regarding electronic signs, section 15-2614 of the Fresno Municipal Code provides that electronic sign copy must abide by the following brightness parameters:

The intensity of the sign lighting shall not exceed 100 foot Lamberts (FT-L) when adjacent to streets which have an average light intensity of less than 2.0 horizontal footcandles and shall not exceed 500 FT-L when adjacent to streets which have an average light intensity of 2.0 horizontal footcandles or greater. No change of lighting intensity may occur during a display or between displays except to respond to a change in ambient lighting conditions.

As discussed above, in night-time conditions, the light output of Outfront’s LED facings is limited to a total of 0.3 footcandle at 250 feet, which converts to 300 nits, or 87.7 foot Lamberts. Accordingly, regardless of what the brightness levels are in surrounding streets during evening hours, Outfront’s Signs would comply with the City’s brightness limitations (i.e., 100 foot Lamberts).

The City’s General Plan does not contain any express provisions regarding billboards or commercial signs, and the City’s Comprehensive General Plan Land Use and Circulation Map and zoning code do not prohibit outdoor advertising displays relocated pursuant to the Outdoor Advertising Act.

As proposed, the Sign complies with all applicable federal, state, and local regulations, and would require only a variance from the City’s height restrictions for pole signs on the Property. For the foregoing reasons, the granting of the variance

will be consistent with the general purposes and objectives of the City's zoning ordinance, applicable land use plans, and the General Plan.

III. Environmental Review.

As you know, any land use entitlement process includes the navigation of environmental review under the California Environmental Quality Act ("CEQA").

Here, the Sign would be exempt from CEQA review under a Class 3 exemption, codified at Title 14, California Code of Regulations, section 15303. The law and facts supporting this determination are set forth below and in the incorporated Lighting Parameter Letter, the latter of which demonstrates the Sign will not have any impacts related to brightness or driver distraction.

The Class 3 exemption covers the "construction and location of limited numbers of new, small facilities or structures ... and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure." (14 CCR, § 15303.) The governing regulation contains a non-exclusive list of examples of small structures, which includes multi-family residential buildings with up to 6 units, as well as up to four commercial structures encompassing 10,000 square feet collectively. The Sign construction project contemplates the construction of a billboard structure located in a commercial, urbanized area; these billboard structures are comparatively small in relation to the exemplars in the CEQA Guidelines (e.g., 6-unit apartment buildings, 10,000-square-foot commercial stores), and thus would appear to qualify as the construction or conversion of a small structure.

Meanwhile, many jurisdictions have approved similarly sized advertising displays using a Class CEQA Exemption. What follows are examples of where California cities and counties have included a Class 3 exemption as part of a billboard's land use entitlement package:

- **City of Oakland.** The city approved a billboard with approximately 1,344 square feet using a Class 3 exemption in 2009. (See <http://clerkwebsvr1.oaklandnet.com/attachments/23903.pdf>.)
- **City of Sacramento.** The city has recommended Class 3 exemptions for billboards on various occasions. (See, e.g., double-panel, 45-foot high billboard relocation with 14' x 48' facing eligible for Class 3 exemption, at http://sacramento.granicus.com/MetaViewer.php?view_id=29&clip_id=2426&meta_id=208944; see also http://sacramento.granicus.com/MetaViewer.php?view_id=29&clip_id=2426&meta_id=208944.)
- **County of Monterey.** The county has approved on multiple occasions billboards using Class 3 exemptions. (See <http://www.co.monterey.ca.us/planning/cca/pc/2005/06-08->

05/PLN040738PC1.pdf;
<http://www.co.monterey.ca.us/planning/cca/pc/2004/10-13-04/PLN040443PC1.pdf>.)

- **City of Perris.** The city approved three double-side digital billboards along Interstate 215 (and removal of other billboards), determining they were exempt under Class 2 and Class 3 exemptions. (See <http://www.cityofperris.org/city-gov/resolutions/2014/4679.pdf>; see also <http://www.cityofperris.org/city-gov/resolutions/2014/4699.pdf>.)
- **City of Fontana.** The city approved an electronic billboard using a Class 3 exemption. (See <http://www.fontana.org/Archive/ViewFile/Item/1737>.)

In addition, a number of California cities have approved “larger,” non-billboard projects in California on the basis of Class 3 CEQA exemptions, as follows:

- **City of Santa Clara.** City staff recently recommended use of a Class 3 exemption to entitle the subdivision of land and creation of two homes totaling about 8,000 square feet. (<http://santaclaraca.gov/Modules/ShowDocument.aspx?documentid=13548>; <http://sireweb.santaclaraca.gov/sirepub/cache/2/pfum4yb4fg0eawlsbnps4auw/71267104162015030929247.PDF> ;
- **City of Loma Linda.** City staff recommended approval of a 65-foot high wireless cell tower with a Class 3 exemption as part of the entitlement package. (<http://www.lomalinda-ca.gov/asp/admin/BCPostingDoc/getCDoc.asp?ID=718>.)
- **City of Fremont.** The city recently applied the Class 3 exemption to allow a 9,763-foot commercial building. (See <http://www.fremont.gov/DocumentCenter/View/25185> .)
- **County of Riverside.** County staff recently recommended the use of a Class 3 exemption to approve a 9,825 commercial retail building. (http://planning.rctlma.org/Portals/0/hearings/pc/2009/pc081909_agenda/sr_7.7.pdf.)

These uses of course are consistent with 14 CCR, section 15303(a)&(c) and interpreting case law (e.g., *Fairbank v. City of Mill Valley* (1999) 75 Cal.App.4th 1243 [use of Class 3 exemption to entitle a 4,855 square foot commercial building]), and this law would support use of a CEQA exemption for Outfront’s Sign construction project, which is lesser in scope than many of the foregoing projects. Construction of the Sign would entail only about two to three weeks of construction and, once installed, would not generate any noise and would require relatively little electricity to operate and very little maintenance. Further, as discussed above in the Lighting Parameter Letter, the Sign’s brightness and copy display would easily meet all applicable federal, state, and local standards.

IV. Conclusion

For the foregoing reasons, Outfront respectfully requests that the City approve Outfront's variance request, allowing the Sign to be constructed at a height of 86-feet, and determine the Sign is exempt from environmental review under a Class 3 CEQA exemption.

Please do not hesitate to contact our office if you have any questions or comments regarding the above.

Sincerely,

MILLER STARR REGALIA

Sean Marciniak



Sean Marciniak
SRM/kli
Attachments

cc: Clients
Anthony Leones, esq., Miller Starr Regalia
Travis Brooks, esq., Miller Starr Regalia
Wilma Quan, City Manager, City of Fresno, Wilma.Quan@fresno.gov
Brandon Collet, esq., City Attorney's Office, City of Fresno,
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Attachment A





















Attachment B



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March 19, 2019

VIA E-MAIL AND FEDEX

Chairman Ron Duarte & Commissioners
Fresno County Airport Land Use Commission
Fresno Council of Governments
c/o Brenda Veenendaal
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E-Mail: brendav@fresnocog.org

Re: Information concerning dwell time and brightness of Outfront Media's digital
outdoor advertising displays

Dear Chairman Ron Duarte and Honorable Members of the Commission:

As you know, Outfront Media LLC ("Outfront") is seeking entitlements to construct and operate two digital outdoor advertising displays in the City of Fresno. The first sign is proposed at a location between North Barton Avenue and California State Route 168 ("Sign No. 1"), and the second sign is proposed at a location between North Howard Street and California State Route 41 ("Sign No. 2"). As you also know, the location of Sign No. 1 is approximately one mile west of the Fresno Yosemite International Airport, whereas the project site for Sign No. 2 is located about 4.6 miles northwest of the airport.

We understand you have expressed concerns about the Signs' brightness and the possibility that its operation might distract pilots and pose a safety risk. Below, we have compiled information and materials that explain how Outfront plans to operate the Sign, particularly with respect to (1) the brightness at which Outfront will broadcast the proposed electronic messaging; and (2) the frequency at which electronic advertisements will change, known as the "dwell time," which informs the risk of distraction. Outfront's operational parameters are consistent with federal, state, and local standards, and in fact are more protective of the public than applicable regulations.

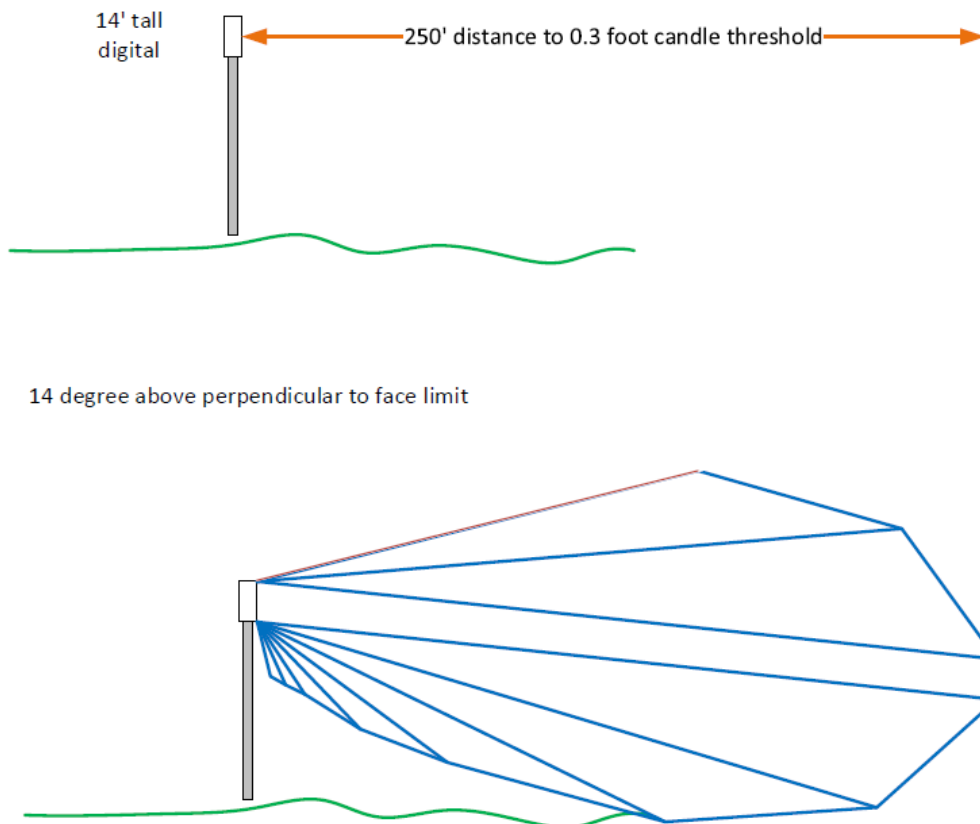
At the end of this memorandum, we've also included a "Q&A," developed in response to questions that agencies and the public frequently have posed about digital billboards. We've also attached to this letter a significant number of "source materials" that support the conclusions herein. If you have any questions about any of these materials, please let us know.

I. Pertinent Details Concerning the Signs

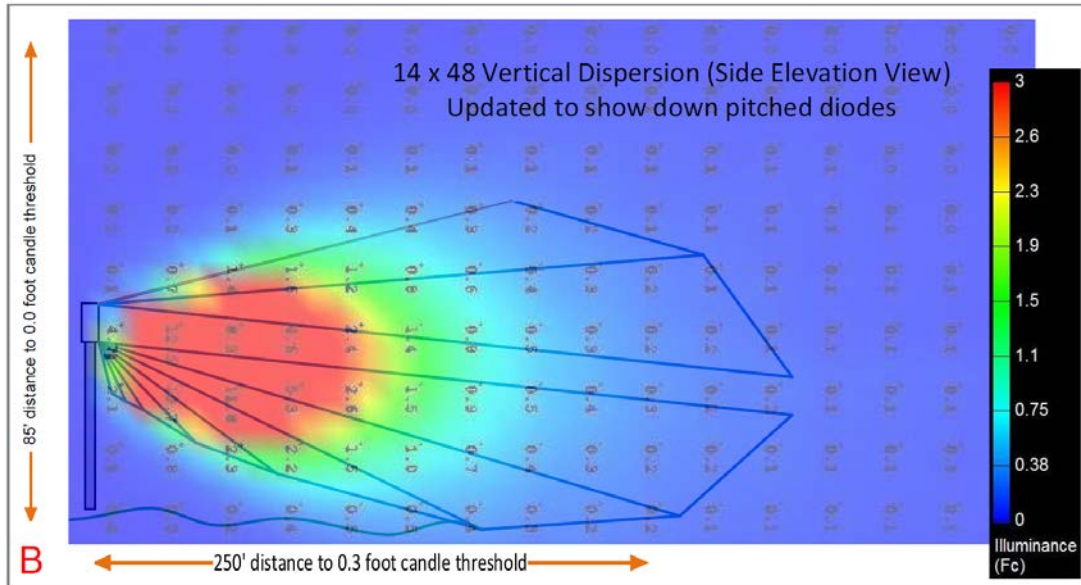
a. General overview of Signs' light "footprints"

Digital billboards are designed with more thought than most realize. A sign's brightness automatically adjusts in response to ambient conditions, as measured by on-site sensors, and ensures the sign operates at a luminosity that is only slightly greater than background conditions. This difference is 0.3 foot candles, measured at 250 feet, which is roughly the brightness one would experience when looking at a candle through a dark filter. (The concept of foot candles and brightness are discussed in greater detail, below, in Sections II and IV.) Notwithstanding the above, during nighttime hours, the light output of Outfront's LED facings is limited to a total of 0.3 foot candle at 250 feet, which converts to 300 nits and 87.7 foot Lamberts. Each of the individual light emitting diodes ("LEDs") on the sign's display facings, meanwhile, is angled downward toward motorists, thereby reducing light pollution and glare when compared to traditionally illuminated signs.

As a consequence, a sign's light "footprint" is fairly minimal. For instance, the vertical footprint of a 60- to 65-foot-high sign with display panels measuring 14 feet by 48 feet is depicted as follows:



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This diagram illustrates differences in brightness through the use of colors, with blue representing smaller differences (i.e., differences of less than 0.1 foot candles), green showing a difference of 0.3 foot candles, and warmer colors (e.g., red, orange, and red) showing greater brightness differences. The vertical light footprint of a 60- to 65-foot sign therefore rises to a height of about 85 feet and, beyond this footprint, changes in brightness are minimal, and generally do not register on a light meter.

Meanwhile, a sign's horizontal footprint is similarly limited in scope, as follows:

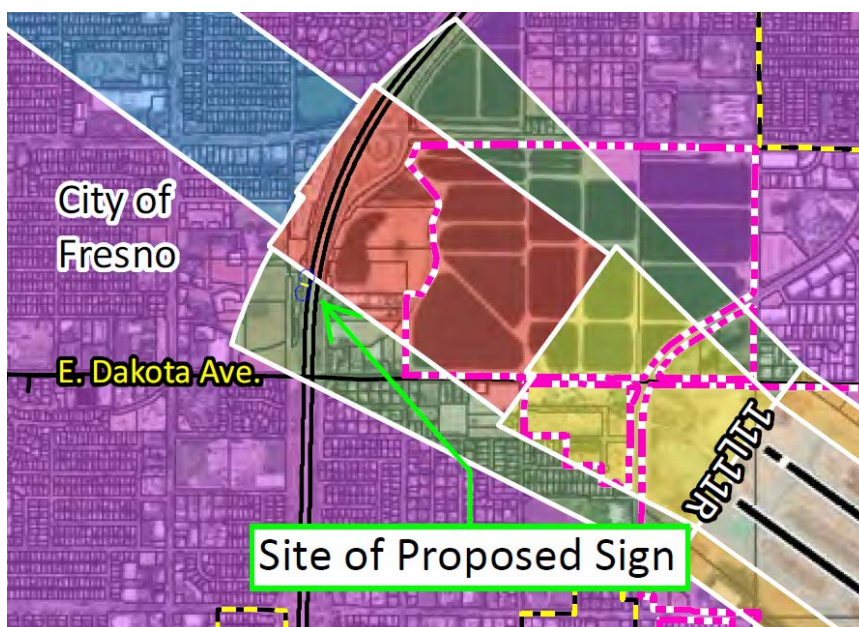


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While digital billboards are clearer than traditionally illuminated signs, they are not brighter. More information about these design characteristics are addressed in the Q&A in Section IV, below.

b. Details specific to Sign No. 1

With respect to the Sign No. 1, it is located about a mile west/northwest of the nearest airport runway. The project site falls within an Inner Turning Zone ("Zone 3"), as identified in the Airport Land Use Compatibility Plan ("ALUC"), which permits most commercial and industrial uses, though requires review of structures exceeding 35 feet in height. (ALUC, pp. 3-3, 3-12, 3-13.) The orientation of the Sign's display facings are approximately parallel to the flight path of arriving and departing aircraft, and therefore it appears pilots would have, at most, oblique views of the displays.



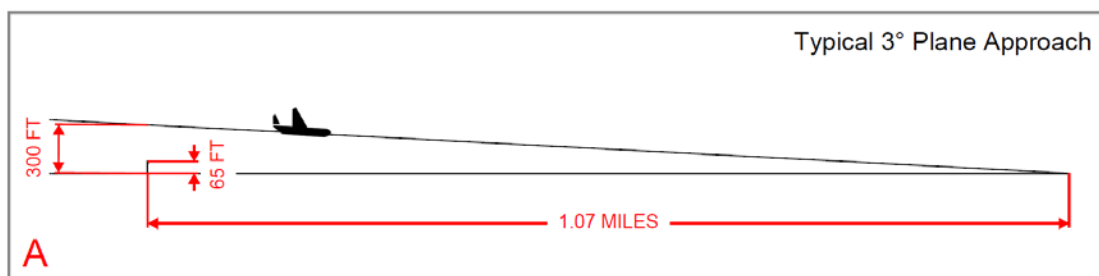
Location of Sign in Zone 3 (area shaded green)



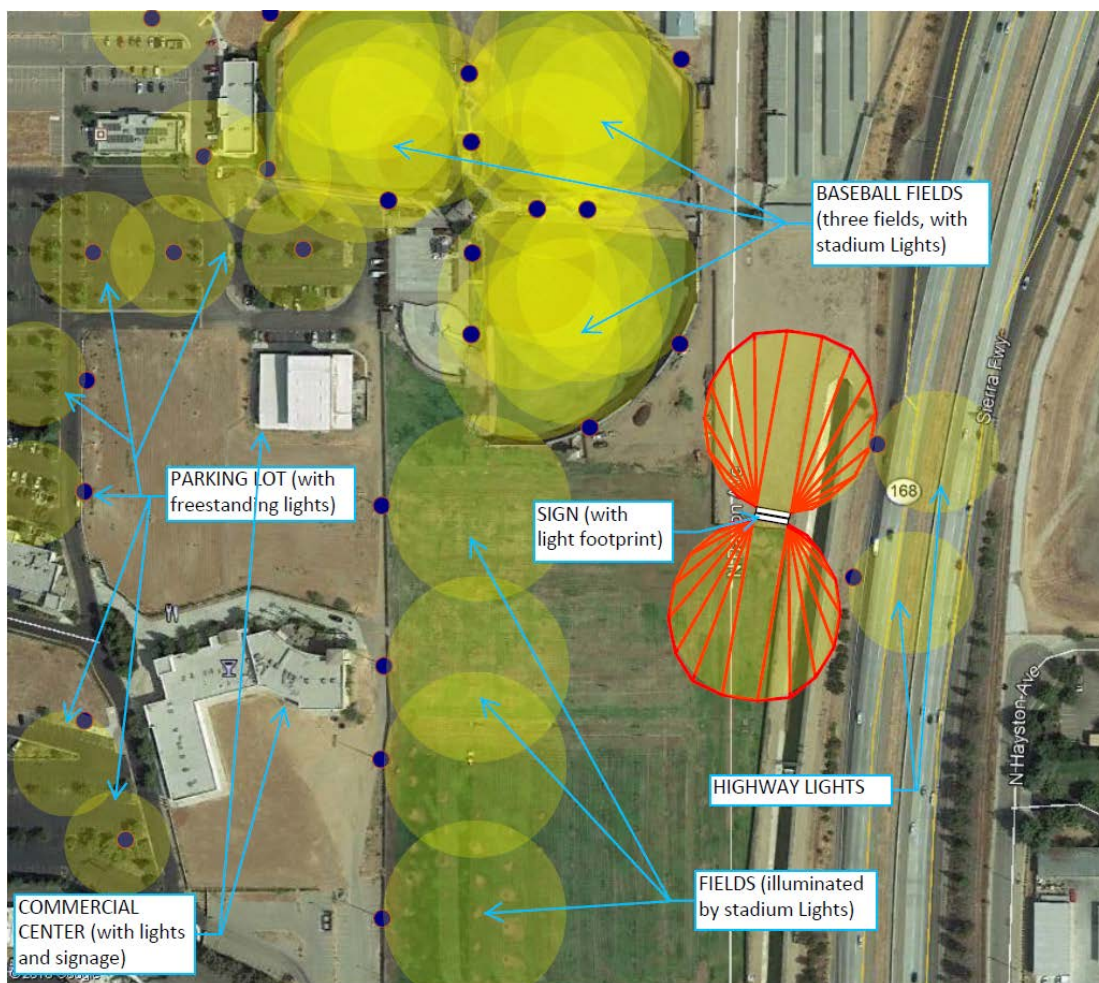
Orientation of Sign is roughly parallel to flight paths

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The top of Sign No. 1, meanwhile, will operate approximately 235 feet beneath the flight path of airlines, as shown on the graphic below.



With regard to the project's setting, the immediate surrounding area contains commercial and recreational uses, including restaurants, offices, a gym, a dance club, a supermarket, a self-storage facility, and a recreational park (i.e., Granite Park).



Purple dots depict light sources; yellow circles depict rough illumination footprints

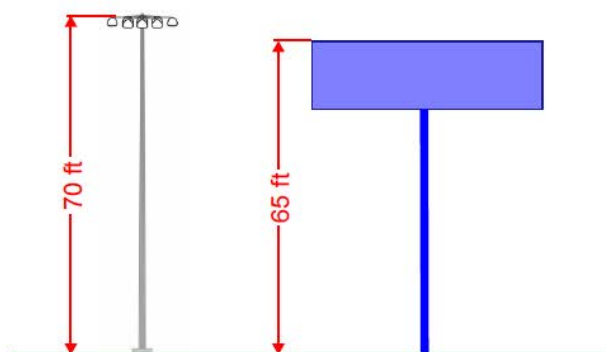
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A depiction of light sources and footprints in the immediate vicinity of the proposed Sign is depicted in the illustrations above. As shown, dozens of lights populate the area, including street lights, parking lights, commercial illuminated signs, and almost twenty high-mast, 70-foot-tall stadium lights. These stadium lights are used to illuminate three nearby baseball fields and other sports fields, and exceed the height of the proposed Sign. The sports fields and lights are depicted on the graphic on the following page.

Granite Park



Denotes location of 70ft
tall Field Lighting pole

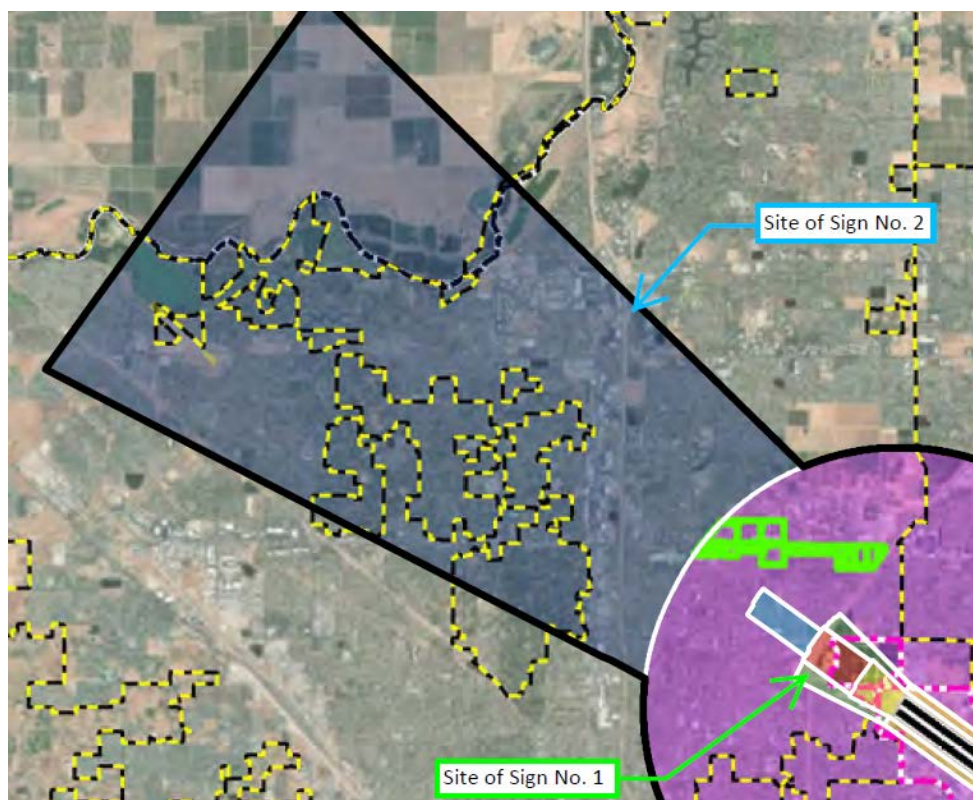


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The Sign therefore would be an “infill” lighting source, surrounded on all sides by dozens of lights that are equal, if not more powerful, in terms of brightness. As discussed in more detail in Sections II and IV, the digital billboards are about equal to traditional billboards in terms of brightness, and in fact have less sky glow. Meanwhile, illumination sources such as stadium lights are designed to illuminate large areas, and are significantly brighter than both types of signs.

c. Details specific to Sign No. 2

With respect to the Sign No. 2, it is located about 4.6 miles northwest of the nearest airport runway. The project site sits on the edge of the airport’s “Precision Approach Zone,” where aircraft accident risks are considered low. (ALUC, pp. 3-3, Exhibit D-1.) A graphic depiction of the location of Sign No. 2 is shown below:

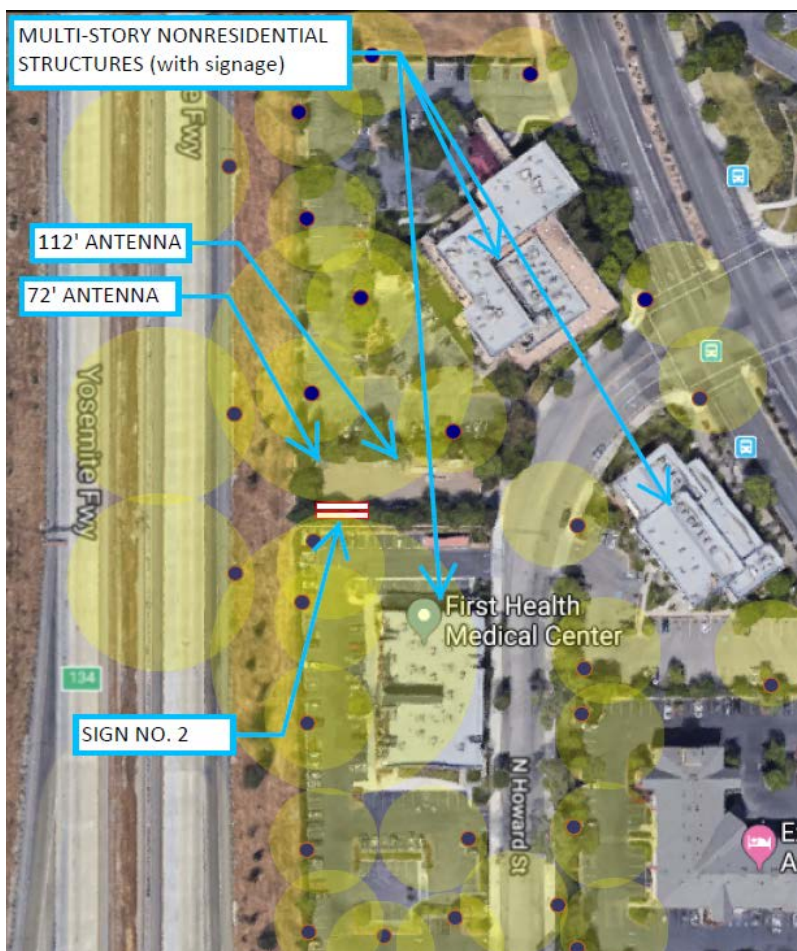


The brightness of Sign No. 2 will be the same as Sign No. 1, and have a similar footprint. While Sign No. 2’s proposed height is 85 feet, as opposed to the 65-foot height of Sign No. 1, the project site for Sign No. 2 is located approximately 20 feet below the height of the nearest highway grade, where the sign’s display facings will be oriented.

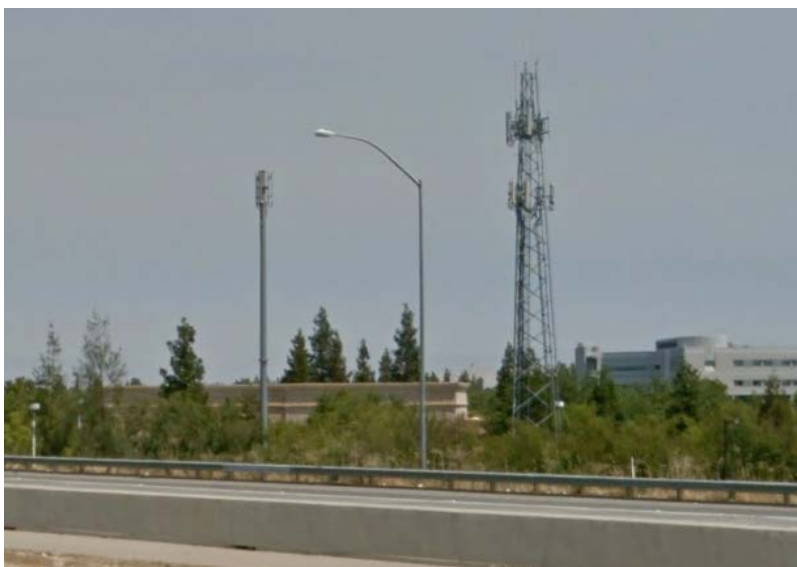
As with the Granite Park location, the location of Sign No. 2 is an “infill” site, surrounded by non-residential buildings, hotels, restaurants, and the freeway. Each of

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these uses are lit with freestanding lights (e.g., parking lot lights) and commercial signage. The location of Sign No. 2 is also situated among two tall cellular antennas, measuring 72-feet and 112-feet tall. The photographs below show the project site and its surrounding uses.



Purple dots depict light sources; yellow circles depict rough illumination footprints



Street view of project site from highway; Sign No. 2 would be 32 feet shorter than the larger antenna

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Accordingly, Sign No. 2 would be an “infill” lighting source, surrounded on all sides by dozens of lights that are equal, if not more powerful, in terms of brightness.

II. Brightness Standards

To better understand the light footprints described in Section I of this letter, it is important to understand how brightness is measured, and the regulatory standards that apply.

California standard.

Business and Professions Code section 5403(g) defines the brightness standard for a digital billboard in relation to Vehicle Code section 21466.5, which provides:

No person shall place or maintain or display, upon or in view of any highway, any light of any color of such brilliance as to impair the vision of drivers upon the highway. A light source shall be considered vision impairing when its brilliance exceeds the values listed below.

The brightness reading of an objectionable light source shall be measured with a $1\frac{1}{2}$ -degree photoelectric brightness meter placed at the driver's point of view. The maximum measured brightness of the light source within 10 degrees from the driver's normal line of sight shall not be more than 1,000 times the minimum measured brightness in the driver's field of view, except that when the minimum measured brightness in the field of view is 10 foot-lamberts or less, the measured brightness of the light source in foot-lambert shall not exceed 500 plus 100 times the angle, in degrees, between the driver's line of sight and the light source.

The provisions of this section shall not apply to railroads as defined in Section 229 of the Public Utilities Code.

Under the foregoing, the most conservative brightness limit with which the Signs would have to comply is 500 foot lamberts above ambient levels,¹ which is equivalent to 1713 nits above ambient levels. Outfront proposes to operate the Signs' night-time limit at 300 candela per square meter, also known as 300 nits, above ambient levels. This brightness level equates to 0.3 foot candles at 250 feet,² meaning that the Signs'

¹ This calculation assumes a minimum measured brightness in the field of view of less than 10 foot-lamberts, and a view angle of zero degrees (i.e., directly in front of the driver).

² Setting a standard in foot candles is a more appropriate metric by which to judge impacts on sensitive receptors, as a foot candela measures light intensity experienced at the receptor, whereas measurement in candela/square meters or nits reveals only the intensity of light at its source.

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maximum brightness would always be about one-sixth of the maximum brightness level allowed under California state law.

For a frame of reference, 0.3 foot candles is comparable to the experience an individual would have if she looked through a dark film at a candle situated one foot away. Another real-world example of a 0.3 foot candle source is the light emanating from a computer monitor. Outfront has no interest in operating its Signs at greater brightness levels, which would make the displays look “washed out” and difficult to read.

City of Fresno Brightness Standard

Under section 15-2614 of the Fresno Municipal Code, electronic sign copy must abide by the following brightness parameters:

The intensity of the sign lighting shall not exceed 100 foot Lamberts (FT-L) when adjacent to streets which have an average light intensity of less than 2.0 horizontal footcandles and shall not exceed 500 FT-L when adjacent to streets which have an average light intensity of 2.0 horizontal footcandles or greater. No change of lighting intensity may occur during a display or between displays except to respond to a change in ambient lighting conditions.

As discussed above, in night-time conditions, the light output of Outfront’s LED facings is limited to a total of 0.3 foot candle at 250 feet, which converts to 300 nits, or 87.7 foot Lamberts. Accordingly, regardless of what the brightness levels are in surrounding streets during evening hours, Outfront’s Signs would comply with the City’s brightness limitations (i.e., 100 and 500 foot Lamberts).

Brightness Standards in Other Jurisdictions

As discussed above, Outfront currently proposes to operate the Signs at issue at a night-time brightness level of approximately 300 nits above ambient levels during the day and 300 nits total at night, which is equal to or less than the standards adopted by the great majority of states. A 2010 report entitled “The Regulation of Signage: Guidelines for Local Regulation of Digital On-Premise Signs” found that a recent survey of numerous jurisdictions showed that the most common regulatory provisions applicable to digital on-premise signs limit brightness changes to 500 or more nits at night. (Menelaos Triantafillou, Alan C. Weinstein, National Signage Research and Education Conference, *The Regulation of Signage: Guidelines for Local Regulation of Digital On-Premise Signs*, (2010), attached hereto and referred to herein as Appendix 1, p. 6; Cal. Dept. of Transportation, Caltrans Division of Research and Innovation, *Effects of Outdoor Advertising Displays on Driver Safety*, (Oct. 11, 2012) p. 3., attached hereto and referred to herein as Appendix 2.) For instance, digital signs in San Antonio, Texas must comply with a maximum brightness level of 2,500 nits at night, while digital signs in Oakdale, Minnesota have a maximum brightness of 500 nits at night. (*Id.*, p. 2.) Meanwhile, Washington state prohibits brightness from exceeding 1,000 nits or equivalent candelas between dusk and dawn (Wash. Admin. Code, § 468-

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66-050(3)(g)(v), attached hereto and referred to herein as Appendix 3; Appendix 2, pp. 10-11), whereas Arizona allows digital signs to operate at 342 nits at night. (OAAA, Issue Brief, Outdoor Lighting and Dark Skies, (Nov. 2016) p. 2, attached hereto and referred to herein as Appendix 4). The regulations in these jurisdictions thus allow digital signs to operate at significantly higher brightness levels than Outfront's proposed operation of the Signs.

Only nine jurisdictions have adopted the more conservative standard (i.e., 300 nits or 0.3 foot candles) with which Outfront proposes to comply, including Colorado, Massachusetts, Michigan, Missouri, New Mexico, Oregon, Tennessee, Wyoming, and Puerto Rico. (See *Id.*, pp. 1-2.; Or. Admin. R. no. 734-060-0007(3)(a)(C), attached hereto and referred to herein as Appendix 5; Appendix 2, p. 4-9; OAAA Digital Technology Brief (February 2015), attached hereto and referred to herein as Appendix 6, p. 3.)

Conclusion

Outfront's Signs will be operated at approximately one-sixth of the maximum brightness levels allowed by California state law. Moreover, as shown below in Section IV, the Signs' contributions to ambient brightness levels generally do not register on light meters beyond 250 feet.

III. Distraction and Dwell Times

Flight hazards, as defined in the ALUC.

In evaluating whether a land use constitutes a visual hazard, the Commission is asked to evaluate whether the use would result in "glare or distracting lights which could be mistaken for airport lights." (ALUC, § 3.4.5, p. 3-18.) As discussed below, advertisements will be static, and change once every eight seconds. They will not flash, and there will be no moving images on the displays.

Dwell time, definition.

"Dwell time," again, is the frequency at which electronic advertisements will change. It is the operating parameter by which federal, state, and local jurisdictions evaluate distraction risks associated with a given outdoor advertising display. As discussed below, the Signs' eight-second dwell time is consistent with all standards; in fact, this dwell time is twice as long as the minimum permitted under state law.

California and federal standards.

California law allows digital signs to operate at a minimum dwell time of no less than four seconds before the display may transition to the next image. This requirement is set forth in Business and Professions Code section 5405(d)(1), which provides, in pertinent part, ". . . 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

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intensity or exposes its message for less than four seconds.” (See *also* Appendix 2, App. A, pp. 13-16.)

The Federal Highway Administration, meanwhile, has approved of a similar dwell time standard. According to a FHWA memorandum, the acceptable range for the “[d]uration of each display is generally between 4 and 10 seconds – 8 seconds is recommended.” (U.S. Dept. of Transportation, Fed. Highway Admin., Guidance On Off-Premise Changeable Message Signs (Sept. 25, 2007) p. 2, attached hereto and referred to herein as Appendix 7.)

City of Fresno Brightness Standard

Under section 15-2614 of the Fresno Municipal Code, advertisements on an electronic display may change no more than once every eight seconds. As discussed above, Outfront’s dwell times comply with this restriction.

Dwell Times in Other Jurisdictions

A Caltrans Preliminary Investigation, published on October 12, 2012, noted that 43 states in the US have set dwell times ranging from four to ten seconds, with six and eight seconds most common. (Appendix 2, App. A, pp. 13-16; see also Appendix 1, p. 6 [“the most common regulatory provisions applicable to digital on-premise signs . . . [r]equire that the sign display remain static for a minimum of 5-8 seconds”].) Specifically, Caltrans noted the following minimum dwell times:

4 seconds – CA, CO, IA, VA

5 seconds – NM, PA

6 seconds (average) – AL, AZ, CT, FL, GA, IA, MI, MN, NV, NY, SD, WI, RI

8 seconds – AR, ID, IN, KS, LA, MO, MS, NJ, NC, OH, OK, OR, SC, TN, UT, WV, WA

Other/State-Company Discretion – KY, MA, MT

(Appendix 2, App. A, p. 14.)

Moreover, a recent federal court further noted that the FHWA identified certain “ ‘acceptable criteria’ based on certain ranges of acceptability that have been adopted in those States that do allow [digital signs] . . . recommending, among other things, that each display generally remain static for between four and ten seconds, and transition to a new display in one to four seconds[.]” (*Scenic America, Inc. v. United States Department of Transportation* (D.C. Cir. 2016) 836 F.3d 42, 46–47, attached hereto and referred to herein as Appendix 8.)

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A Dwell Time of Eight Seconds Does Not Adversely Impact Safety

Jurisdictions have not crafted their regulations on the basis of flight safety, but on the basis of motorist safety, as digital signs are more proximate to, and designed to attract the attention of, motor vehicle drivers.

An OAAA Digital Technology Brief dated February 2015, attached hereto and referred to herein as Appendix 6, notes that “digital billboards” display static images that typically transition every six or eight seconds. Of particular significance, the report also noted the following:

Effective January 1, 2015, New York State switched from 24-hour to 8-second display time on digital billboards. New York’s analysis of crash data “suggests there is no change in the crash patterns in the vicinity of the off-premise [digital]³ billboards,” and continued monitoring is warranted. (Appendix 6, p. 4, emphasis added.)

Further, the FHWA conducted two studies on driver visual behavior with regard to electronic billboards, and released a report documenting its findings entitled “Visual Behavior in the Presence of Commercial Electronic Variable Message Signs (CEVMS).” (William A. Perez et al., U.S. Dept. of Transportation, Fed. Highway Admin., Driver Visual Behavior In The Presence Of Commercial Electronic Variable Message Signs (CEVMS), (Sept. 2012), Report No. FHWA-HEP-16-036 attached hereto and referred to herein as Appendix 9.) The report explained that the studies were “conducted to provide the FHWA with data to determine if [digital signs] capture visual attention differently than standard off-premise advertising billboards.” (*Id.* at 5.) The studies were initiated in response to a safety concern raised by Scenic America, a nonprofit organization seeking to preserve the scenic qualities of America’s roadways. (*Ibid.*) Specifically, the FHWA report noted:

[T]he current Federal Highway Administration (FHWA) guidance recommends that [digital billboards] should not change content more frequently than once every 8 seconds. However, according to Scenic America, [digital billboards present a safety concern in that] the “...distinguishing trait...” of a digital billboard “... is that it can vary while a driver watches it, in a setting in which that variation is likely to attract the drivers’ attention away from the roadway.”

(*Ibid.*)

Drivers in Richmond, VA and Reading, PA participated in the FHWA studies on driver distraction. (*Id.* at 6.) The billboards in the study “changed content approximately every 8 to 10 seconds.” (*Id.* at 2.) The FHWA report noted that the presence of digital billboards did not correlate to a decrease in looking toward the road ahead. (*Ibid.*)

³ These publications refer to digital signs as CEVMS. CEVMS is an acronym for Changeable Electronic Variable Message Signs.

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Moreover, the report found that glance duration toward digital billboards averaged 0.379 seconds, while glances at static billboards were at 0.335 seconds at both test sites — a difference of about four hundredths of a second. The results did not provide evidence indicating that digital billboards, as deployed and tested in the two selected cities, were associated with unacceptably long glances away from the road. (*Id.* at 54.) In fact, the report noted that “the average fixation durations to [digital] and standard billboards were similar to the average fixation duration to the road ahead.” (*Id.* at 2.)

The FHWA concluded:

The present data suggest that the drivers in this study directed the majority of their visual attention to areas of the roadway that were relevant to the task at hand (e.g., the driving task). Furthermore, it is possible, and likely, that in the time that the drivers looked away from the forward roadway, they may have elected to glance at other objects in the surrounding environment (in the absence of billboards) that were not relevant to the driving task. When billboards were present, the drivers in this study sometimes looked at them, but not such that overall attention to the forward roadway decreased.

(*Id.* at 4; see also Darrin Friskney, Federal Highway Administration study confirms safety of digital billboards and signs, published June 16, 2014, attached hereto and referred to herein as Appendix 10.)

Finally, a study conducted by experts at the University of Utah found that in-vehicle information systems (e.g., gadgets, buttons, etc. inside the vehicle) create “moderate to high level cognitive workload for drivers,” and that after drivers interact with these information systems, it takes about 27 seconds to return to normal levels of performance. (Ken Klein, *The Hunt For Distractions Leads To Inside The Vehicle* (May 4, 2016) Billboard Insider <<http://billboardinsider.com/the-hunt-for-distractions-leads-to-insider-the-vehicle/>> [as of Dec. 5, 2016], attached hereto and referred to herein as Appendix 11.) This study suggests that in-vehicle information systems pose significantly greater risks than Digital signs.

There is no evidence that operation of billboards impacts aviation safety

There are hundreds of billboards located near airports, and there is no evidence their operation has impacted aviation safety. While most of the billboards are traditional, illuminated displays, the brightness of these displays is comparable to the brightness of digital billboards, and in fact the older signs cast more light into the air than their digital counterparts. (See discussion in Section IV, below; see also EXP Light Study, Fresno, Route 168, Digital Billboards, attached hereto and referred to herein as Appendix 12.)

Outfront currently operates two digital billboards near airports, including (1) an LED display at 4633 World Parking Circle in St. Louis, located about 0.8 miles southwest of the nearest runway St. Louis Lambert International Airport; and (2) an LED display on N. 24th Street in Phoenix, located about .4 miles west of the nearest runway at the Phoenix Sky Harbor International Airport.

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The digital sign near the St. Louis airport is depicted below:



Location of digital display at 4633 World Parking Circle, St. Louis, about 0.8 miles southeast of runway



Birds-eye view of digital display at 4633 World Parking Circle (lower left); airport runway at top of photo

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these two existing LED displays has caused any accidents at the aforementioned airports.

Conclusion

All evidence demonstrates the Signs will not pose a flight hazard which, again, is defined as “glare or distracting lights which could be mistaken for airport lights.” (ALUC, § 3.4.5, p. 3-18.) The Signs would not cause glare, or be mistaken for airport lights, for the following reason:

- The Signs will display advertisements on 14-foot by 48-foot display facings, which are dissimilar to any airport lights;
- These display facings will operate at a brightness level of 0.3 foot candles, when measured at 250 feet, above ambient levels in the daytime, and at a total of 0.3 footcandles at night, which means the Signs, at their brightest, will operate at roughly one-sixth the maximum brightness allowed by state regulations;
- The LED bulbs in the Signs’ display facings are pointed downward, toward motorists, and their vertical light footprint will not trespass any higher than about fourteen feet above the tops of the Signs;
- The Signs will be located in the immediate vicinity of numerous illuminated commercial signs, parking lights, street lights, and therefore will be one light source among many in urbanized areas;
- In addition, Sign No. 1 is located immediately east of almost twenty 70-foot-tall stadium lights, whereas Sign No. 2 is located on a property that also accommodates a 72-foot-tall antenna and a 112-foot tall antenna;
- The east-west orientations of the Signs roughly parallel flight paths (i.e., the electronic messaging will not face incoming or outgoing pilots);
- Sign No. 1 and its surrounding, urbanized uses are located almost a mile west/northwest of the runway, whereas Sign No. 2 and its surrounding, urbanized use are located more than a mile northwest of the runway; and
- Advertisements on the Signs’ display facings will change only once every eight seconds — they will not flash, there will be no moving images on the displays, and they will not replicate any airport lights.

Given these circumstances, it does not appear the Sign would cause any upward glare, or that lights on its display facings could be mistaken for airport lights.

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IV. Questions & Answers

Throughout the years, Outfront has received a great many questions from city and county decisionmakers, as well as the public, about how its signs are operated, and what impacts they have on a community. Below, we've included those questions that most frequently come up, and the answers. These answers are based on the materials attached to this letter, and the input of industry lighting experts.

Question 1: Which is brighter, an LED sign or a traditional, vinyl billboard illuminated by flood lights.

Short answer: On the highway where motorists will see any given sign, LED signs are very slightly brighter; outside this targeted area, such as in neighborhoods, the brightness of LED signs are equal or less than the brightness of traditional billboards.

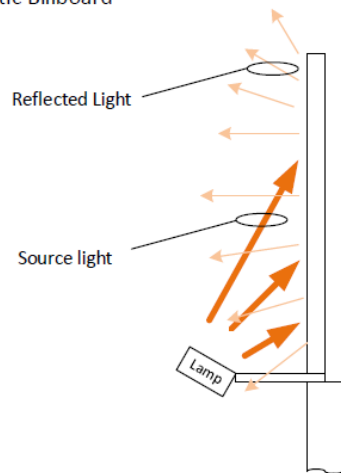
Longer answer: To best understand the answer to this question, it first is necessary to understand how traditional, static billboards are illuminated. To reach an audience, the illumination of traditional billboards is imprecise; the billboard face is blasted with light at a level ranging from 31 to 312 times the brightness of an LED bulb (where brightness variations within that range depend on the bulb's color), and light reflects off the sign's vinyl surface in all different directions. As such, the target audience is reached along with a host of others, and this is why receptors see, for instance, sky glow from traditional, illuminated signs.

By contrast, LED billboards are very precise, in that they are focused on and directed at a specific target audience, and receptors in the periphery are affected at a much lesser level. The graphics below illustrate this "targeting" principle and the difference between LEDs and static billboards.

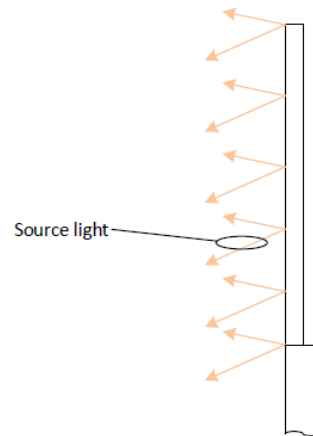


Efficiency of Static vs Digital Billboards

Static Billboard



Digital Billboard



Description	Static	Digital	Comment
Technical description of light	Illumination	Lumination	
Light source	4 each Metal Halide Floods	LED surface	
Light angles at light source	Directed through glass lens	Specific to diodes and louvers	Flood lamps are set to 30 degree apex for calcs
Light pattern from sign face	Scattered	Specific to diodes and louvers	
Number of fixtures	4	N/A, surface light only	
Candelas per fixture	31300	Surface output is variable	
Total candelas	584789	Surface output is variable	
Light to specific target	Random	Mathematically determinable	Variations of lens, reflectivity of copy, etc effect flood light scatter
Source light output for full white copy in candela	584789	18729	Static is 31 times more candela at light source (Fig A)
Source light output for full green copy in candela	584789	11267	Static is 52 times more candela at light source (Fig B)
Source light output for full red copy in candela	584789	5618	Static is 104 times more candela at light source (Fig C)
Source light output for full blue copy in candela	584789	1873	Static is 312 times more candela at light source (Fig D)
Source light output for typical copy without white background	584789	6000	Static is 97 times more candela at light source (Fig E)



Fig A



Fig B



Fig C



Fig D

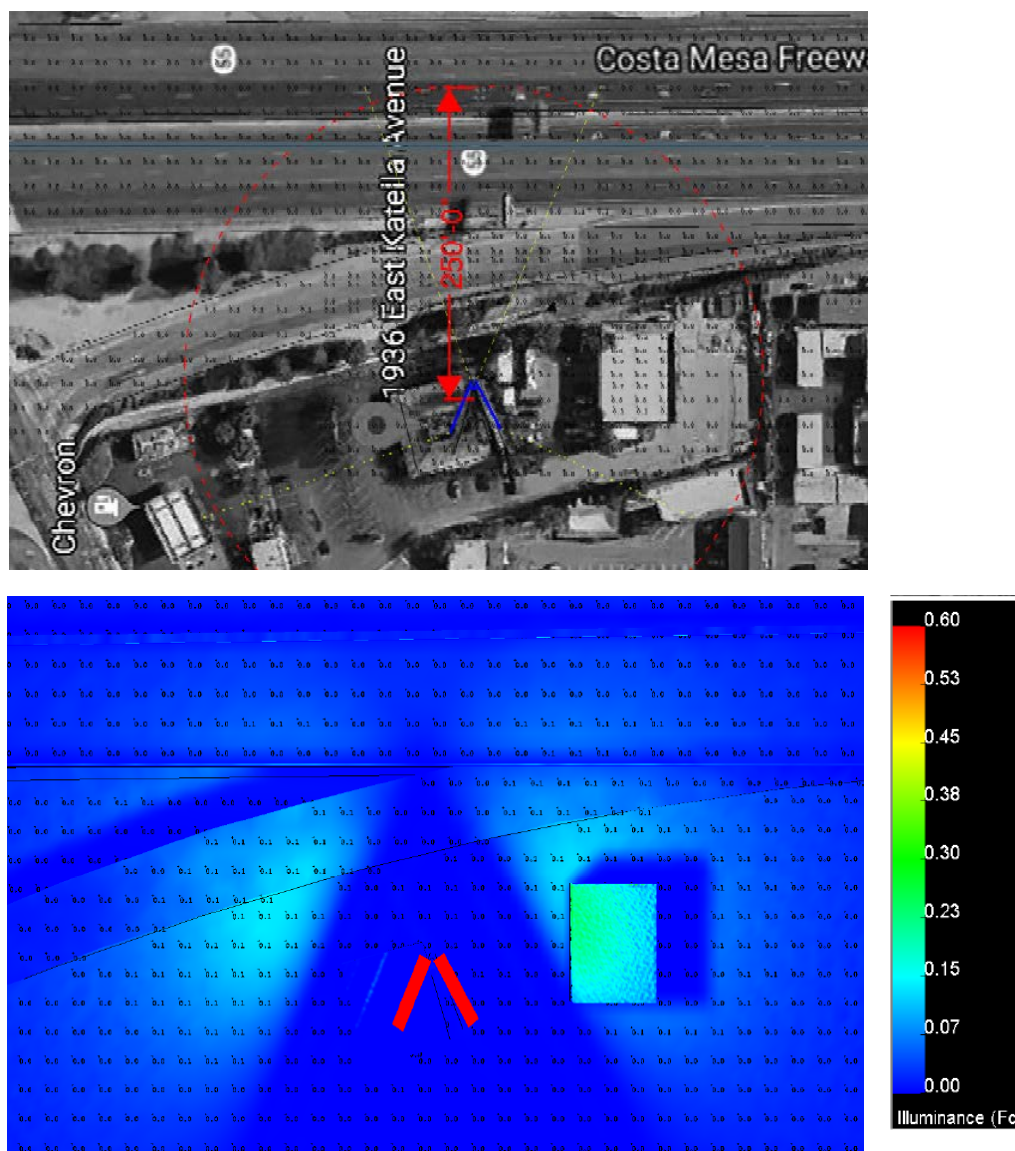


Fig E

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So is an illuminated static display brighter? Any difference in brightness between a static and an LED billboard is negligible beyond 250 feet, and likely would not even register on a light meter. We know this because, when one looks at light studies for digital billboard, one sees that, beyond 250 feet, the change in light is less than 0.1 foot candles, and often close to 0.0 foot candles.

Below are excerpts from a light study prepared for an Outfront LED display in Southern California, showing the brightness “footprint” of a sign when operated at 0.3 foot candles above ambient levels. This study shows a light footprint consistent with the light study performed for Sign No. 1. (See Section I, above; see *a/so* Appendix 12.)



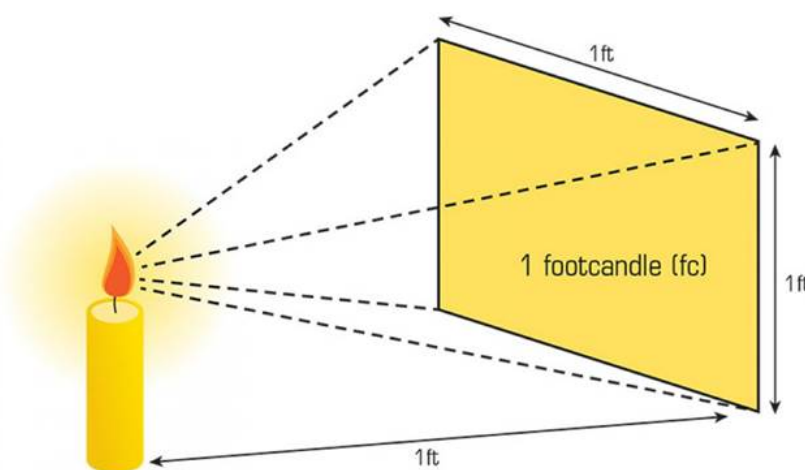
Similar to the graphic on page 3 of the letter, this overhead diagram illustrates differences in brightness through the use of colors, with blue representing smaller differences (i.e., differences of less than 0.1 foot candles), green showing a difference of 0.3 foot candles, and warmer colors (e.g., red, orange, and red) showing greater brightness differences. The study shows that, beyond 250 feet, the brightness difference rounds out to 0.0 foot candles, and therefore is unlikely to be detected on light meters.⁴

The footprint of a traditional illuminated billboard would be nearly the same, though perhaps with greater brightness levels at periphery locations. Accordingly, an LED billboard produces about the same amount of light directly in front of the billboard, and less light at peripheral locations. In no case does brightness increase to any measurable extent beyond 250 feet.

Finally, it should be mentioned that digital signs incorporate technology that takes account of existing ambient lighting and, during daytime hours, ensures light from the sign never exceeds 0.3 foot candles at 250 feet above ambient conditions (again, during the nighttime, a display's brightness is restricted to a total of 0.3 foot candles at 250 feet). A traditional illuminated sign has "one-speed," and emits light at the same brightness regardless of ambient conditions. Under some ambient light conditions, then, a traditional sign will in fact create more light pollution than an LED sign.

Question 2: What is a foot candle, in lay terms?

Answer: A foot candle is the amount of light a single candle makes at a distance of 1 foot (see illustration to the right), and so a 0.3 change in foot candle would be 30 percent of the light one would experience at 1 foot away from a candle. To apply this in a real-world example, if a person in the dark cabin of an airplane, sitting four rows in front of you in an aisle seat, opened a Word document on a 17" laptop, you would experience a 0.3 foot candle increase of light.



⁴ Note, at 250 feet, light generally is less than 0.3 foot candles at ground level because the sign facings are generally located significantly above grade.

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Question 3: If all the above is true, why do digital billboards appear more noticeable?

Answer: Terms like “noticeable” do not have a scientific underpinning. Many who ask this question are responding to the fact that digital signs often appear *clearer* than traditional signs. But enhanced clarity is not the same as increased brightness. For example, when one replaces an older, cathode ray tube television with a newer, 4k screen, the picture appears crisper and more engaging. The brightness, however, does not change.

V. Summary

The information and sources cited above demonstrate that the Sign, as designed, will not have any significant light-related or safety impacts. Its operation will comply with the dwell time and brightness standards espoused by the California legislature, the state, and the federal government, where these standards are supported by scientific analysis and constitute substantial evidence. In fact, as explained above, the Sign would comply with much more conservative standards than required by law.

Again, please let us know if you or the City has any further questions.

Sincerely,

MILLER STARR REGALIA



Sean Marciniak

SRM

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The Regulation of Signage: Guidelines for Local Regulation of Digital On-Premise Signs

Menelaos Triantafillou – University of Cincinnati

Alan C. Weinstein – Cleveland State University

Introduction

Advancements in technology and their application to signage have been a constant in the evolution of signs, their design, and their role in defining physical places. Parallel to this, with each successive application of new technology to new signs – internal/external lighting, backlit awnings, and currently digital sign technology or electronic message centers -- local governments have found themselves unable to understand the new sign technology or the specifics of how to regulate the new types of signs it allowed. Eventually, during the first phase of the use of new technologies, sign regulations are amended to impose various restrictions on the new type of signs. During subsequent phases, a more balanced picture emerges because more knowledge about the new technology becomes available, the sign industry provides more options and technical specifications to address community concerns and meet statutory standards, and local governments gain experience with regulating these new signs,.

Perhaps there are no better places that illustrate the evolution in sign design, specifically lighting and graphics, and the integration of new sign technology in a concentrated district than Times Square in New York City and “The Strip” in Las Vegas. Even though these districts do not resemble the typical American commercial strip, their current visual character is the result of the evolution of new technology in the design of signage and its use in a very defined space.

In the 1890’s, the introduction of incandescent light bulbs made the electrification of Broadway possible and began to give a new aesthetic to New York’s theater district and Times Square. The first electrically-illuminated sign appeared in Times Square 1892 and was an advertisement for a Coney Island resort. Signs illuminated with light bulbs replaced the previous hand painted wooden billboards that

were primarily textual in nature, similar to signs that are the average preference for Main Street-type historic places. Times Square became known as “The Great White Way” due to its saturation of electric billboards and signs in theater marquees, restaurants, and shops. There were many negative reactions to the use of this new technology that added colorful lighting displays to the content of building signs and billboards. The concentration of specific land uses, the theaters, and the location of the square were driving the continuous need for exciting signs. New advances in technology fed the need for inventing new creative graphics. Gradually, the current character of Times Square emerged, but each time technology made it possible to invent a new sign, opposition by New Yorkers resulted in regulatory responses. Finally, in 1987, a comprehensive signage ordinance was enacted to regulate billboards on buildings.

Today, Times Square and the Las Vegas “Strip” contain some of the world’s largest signs and the new technology of Electronic Message Centers is defining a new era of exciting graphics, messaging, and place definition making these two districts unlike any other place in the world. With the collaboration of the sign industry, the businesses, the regulators and the elected officials, both Times Square and “The Strip” have evolved into unique districts with a distinctive character.

But how much of this new sign technology can – or should be – adapted to the rest of the country -- to “Mainstreet USA”? And, what are the appropriate regulatory options for local governments to consider when businesses and sign companies seek to introduce this technology in their communities? These questions are the focus of this session.

New Technology

Currently, the concern with the applications and regulation of on-premise digital sign technology is in its initial phase, marked by confusion among the planning and zoning community both as to how these signs work and how they can and should be regulated. Further adding to the confusion is the fact that the technology is evolving rapidly, offering exciting possibilities for new types of sign displays in exterior and interior environments. For example, during the opening ceremonies of the 2008

Beijing Olympics, the floor of the stadium was equipped with a 3000 sq m video digital screen that used very similar type LED technology.

Technically, digital signs are a more complex and graphically versatile technology than what planners are used to: internally or externally illuminated signs that present a fixed message. Rather than using incandescent lamps or fluorescent tubes as a light source, digital signs use light-emitting diodes (LEDs), a semiconductor-based light source. LEDs transmit across the visible, ultraviolet and infrared wavelengths, and can generate very bright colors. According to Wikipedia, when a light-emitting diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. An LED is usually small in area (less than 1 mm²), and integrated optical components are used to shape its radiation pattern and assist in reflection.

Key Issues with LED Signage

Digital sign manufacturers operate at the national level and that makes it difficult for local planners to have direct access to the technology before an application for a sign permit is made through a local sign company. In addition, there are no national standards for the production of digital signs; however, the sign industry, through the International Sign Association, is working with various states to develop such standards. In short, digital signs present planners with the question of how to regulate a type of sign that uses a new technology and is dynamic, rather than the static signs to which they are accustomed ... and there is little guidance to answer that question. Thus, local government is asked to issue a permit for something it does not understand.

Assuming the local government does not have any regulations that are specific for digital sign technology, what does it do? Usually it will copy another community's requirements. But how were those regulations developed? Most local governments have limited experience with LED signs, mainly from electronic billboards on highways, a small number of electronic message centers signs in commercial areas, and signs embedded in the monument signs of houses of worship and administration

buildings. In fact, most of the reaction to digital signs from APA and other groups is focused on the off-premise digital billboards with many studies looking at the issue of driver's safety when reading the bright and changeable billboard messages. Research by the Federal Highway Administration and the Transportation Research Board has been examining digital signs along highways. In addition, APA has reviewed a few communities that have enacted amendments to their sign codes to address digital signs, mainly focusing on digital billboards. These studies do not directly help the local planner and zoning regulator with the enactment of local regulations to manage on-premise LED-based signs. Specific knowledge from research of commercial environments at the local level where digital signs will need to be incorporated into the existing signs and visual character is not yet available. That said, the International Sign Association has been funding research to address key aspects of digital signs and is working with the States to develop standards.

Electronic Message Center Sign Luminance

An important question is: What level of digital sign brightness is acceptable at night? Many local sign ordinances include standards and guidelines for commercial signs that employ a variety of light source types (fluorescent, neon, incandescent and high intensity discharge such as mercury, metal halide or high pressure sodium). These signs have a fixed message. The lamps inside the sign illuminate letters or symbols that do not have the ability to change what is displayed on the sign: a graphic that was approved by the building/zoning department. In these signs, the only change possible is through switching on or off or dimming certain parts of the sign.

Digital signs, on the other hand, use LEDs and the sign face consists of a multitude of closely spaced dots of pixels or light elements similar to a television screen. These signs are controlled by a computer and their message can change and be displayed as a colored image on the sign's face. As a result, the brightness of the displayed image changes according to the program that drives it and the sign can produce varying levels of luminance. Consequently, the regulation of lighting limits will depend on the signage graphic display program, its location within an environmental zone (*i.e.* dense urban areas where there is much electric light as opposed to 'darker'

suburban and exurban areas), the size of the sign, and the distance from which it is seen.

At present, most communities that regulate the luminance of on-premise digital signs have merely copied the standards that have been previously applied to digital billboards. Typically, these currently call for a maximum luminance of 5000 nits during daylight hours and 500 nits at night; however, the daylight luminance will likely be increasing to 7,500 nits based on discussions between the off-premise industry and the federal government.

Methodologies are being developed that will allow to compute new maximum levels of luminance depending on the factors explained, and their placement and proximity to residential areas.

Changing Display Message and/or Image

The programmable change of messages and/or images in a combination with vivid colors and graphics makes digital signs unique. Digital signs have the ability to accommodate any changing display pattern through the computer program that drives them and turn on and off color and brightness to compose new images. Static signs do not change their message and/or image. Most sign ordinances do not permit flashing signs or 'light movement' on the sign. A key question with digital signs is: Should the number of changes in the display be regulated? If yes, how do we establish a practical and defensible number? What should the time interval (in seconds) be between each successive display frame? Currently, there are no unified standards among the local sign ordinances that have been amended to accommodate digital signs. Of the ordinances sampled/referenced, most have considered the research done for billboards and have focused on driver distraction from changing messages. Approaches range from a complete ban on digitally changing graphics to the use of arbitrary guidelines and standards. Currently, many communities have adopted an 8 second static image requirement derived from an interim guidance recommendation issued by the federal government that governs off premise advertising signs/ billboards.

. However, as was pointed out, local commercial areas where on-premise signs are installed and are regulated are different than highways where off-premise billboards are located.

Digital Display Sign Size, Height, and Placement

Sign size and height have been key considerations of sign regulations. Almost all existing sign regulations have provisions for sign size that arbitrarily set total sign area without considering driving speeds, the driver's cone of vision, the sight distance needed to read a sign, or reaction time after the sign is read to make a decision to turn. The United States Sign Council has conducted considerable research on these issues and has developed standards and guidelines to address them effectively. In addition the Council has developed guidelines to be used to determine size of lettering so that it can be detected by the driver. On-premise digital signs need to be regulated on the basis of the standards and guidelines developed by the United States Sign Council and we will provide recommendations on how to address these and other issues with regard to the regulation of on-premise digital signs discussed during this session.

Current Practice

Based on a recent survey of numerous jurisdictions by one of the authors, the most common regulatory provisions applicable to digital on-premise signs appear below:

- Require that the sign display remain static for a minimum of 5- 8 seconds and require “instantaneous” change of the display; *i.e.*, no “fading” in/out of the message.
- Prohibit scrolling and animation outside of unique – and mostly pedestrian-oriented – locations.
- Limit brightness to 5,000 nits during daylight and 500 nits at night.
- Require automatic brightness control keyed to ambient light levels.
- Require display to go dark if there is a malfunction.
- Specify distancing requirements from areas zoned for residential use and/or prohibit orientation of s sign face towards an area zoned for residential use.

Opportunities for the Use of LED On-Premise Signage in the Local Commercial District

At the local commercial district or arterial strip the character of the environment and the driving speed are different than the highway where billboards are mostly located. The regulation of billboards at the local commercial districts varies from State to State and it is not really relevant to the regulation of on-premise signs. A typical commercial area already has many signs dispersed throughout a very loose mix of mostly freestanding buildings, parking lots, and utility poles and wires. Its character, including signage, evolved over a long period of time. The focus on the new technology and signs cannot ignore the existing spatial arrangements and the relationship with existing signs. Regulations will need to be applied in concert with the total environment, not by isolating these new signs. If planners were to apply a comprehensive approach to the management of signage, regulations for on-premise digital signs will be more effective and can also provide a way to 'visually decongest' existing strip commercial areas from ill-placed and ineffective signs.

Planners also need to consider differing approaches to digital signs for different types of zoning districts. What may be appropriate in a regional commercial district may well be "too little" signage for a downtown entertainment or sports arena district and "too much" for a neighborhood commercial district. In this regard, planners may want to consider using the "character areas" approach of the SFI Model Sign Code as a guide to the development of digital sign regulations that are tailored to specific zoning districts, as suggested below.

Character Area	Motion Limitation	Size Limitation		Could Apply to Part of Character Area
		EMCs as a Maximum % of the Total Sign Area Permitted on the Site	EMCs as a Maximum % of a Single Sign	
Downtown	8 seconds to Unlimited	30% to 100%	100%	Yes
Small Commercial - Suburban	8 seconds	30% to 50%	67%	No
General Commercial	8 seconds to Unlimited	30 % to 50%	80%	Yes
Highway Commercial (1)	8 seconds	30 % to 50%	80% to 100%	No
Mixed Use	8 seconds to 1 second	15% to 30%	50% to 80%	No
Offices	8 seconds to 1 second	15% to 30%	50% to 67%	No (2)
Industrial	8 seconds to Unlimited	30% to 50%	50% to 80%	No (2)

(1) Assumes that Highway Commercial is a relatively small geographic area focused at a highway interchange

(2) Harder to make distinctions among various locations in the office and industrial zone.

Excerpts from:

Preliminary Investigation

Caltrans Division of Research and Innovation

Produced by CTC & Associates LLC

Effects of Outdoor Advertising Displays on Driver Safety

Requested by

Suzy Namba, Caltrans Division of Design

October 11, 2012

The Caltrans Division of Research and Innovation (DRI) receives and evaluates numerous research problem statements for funding every year. DRI conducts Preliminary Investigations on these problem statements to better scope and prioritize the proposed research in light of existing credible work on the topics nationally and internationally. Online and print sources for Preliminary Investigations include the National Cooperative Highway Research Program (NCHRP) and other Transportation Research Board (TRB) programs, the American Association of State Highway and Transportation Officials (AASHTO), the research and practices of other transportation agencies, and related academic and industry research. The views and conclusions in cited works, while generally peer reviewed or published by authoritative sources, may not be accepted without qualification by all experts in the field.

- The message change interval should not exceed 2 s.
- The displayed image should remain static from the moment it first appears until the moment it is changed.
- No animation, flashing or moving lights should be allowed.
- No message or image that could be mistaken for a traffic control signal should be displayed.
- Messages should be simple and concise.

United States

New York State

Regulations proposed in 2008 include:

- Minimum message duration of 62 seconds, so that no motorist would be able to see more than one message change as he or she approached any particular changeable electronic variable message sign.
- Message transition time should be instantaneous to minimize distraction.
- Minimum spacing between changeable electronic variable message sign is 5,000 feet.
- Maximum changeable electronic variable message sign brightness of 5,000 cd/m² in daylight and 280 cd/m² at night.
- Prohibited locations:
 - o On interstate and controlled access highways: Within 1,100 feet of an interchange, at-grade intersection, toll plaza, signed curve or lane merge/weave area; within 5,000 feet of another changeable electronic variable message sign or official traffic device that has changeable messages.
 - o On primary highways: Within 1,100 feet of an entrance or exit from a controlled access highway, a signed curve or a lane/merge area; within 5,000 feet of another changeable electronic variable message sign or official traffic control device with changeable messages.

Revised criteria made these requirements less restrictive, reducing message duration from 62 to 6 seconds and changing spacing requirements and prohibited locations. The requirements for instantaneous message transition and maximum brightness did not change.

San Antonio, TX

Regulations for a trial evaluation of 15 off-premise digital signs included a message duration time of 10 seconds; change intervals of one second or less; brightness less than or equal to 7,000 nits during the day and 2,500 nits at night; and various other regulations. (One nit = one candela per square meter.)

Flowery Branch, GA

Regulations in this community begin on page 138 of the report and include:

- Minimum message duration: to the amount of time that would result in one message per mile at the highest speed limit posted within the 5000 feet approaching the sign for the road from which the sign is to be viewed.
- Transition time: less than one-tenth of a second, with no animated transitions.
- Illumination and brightness: not greater than 12 foot-candles from the nearest point of the road.
- Freezing of the display on malfunction.
- Prohibition of message sequencing.

Oakdale, MN

Brightness is limited to 2,500 nits during the day and 500 nits at night, with adjustments for ambient light conditions and a minimum display duration of 60 seconds.

State Regulations

State and Local Regulation Summaries

State Changeable Message Chart, Outdoor Advertising Association of America, undated.

http://www.superliciousdesign.com/ledmedia/State_Changeable_Message.pdf (or see [Appendix A](#)).

This chart summarizes changeable message advertising sign regulations for 46 states:

- Three states (New Hampshire, North Dakota and Wyoming) do not allow these signs.
- Five states (Maryland, Massachusetts, Oregon, Texas and Washington) allow tri-action signs only.
- Thirty-eight states allow changeable message signs. Of these, 19 states (California, Colorado, Connecticut, Delaware, Florida, Georgia, Indiana, Kansas, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oklahoma, Tennessee, Utah, Virginia and Wisconsin) have statutes; 10 states (Arkansas, Idaho, Illinois, Iowa, Louisiana, Nebraska, Nevada, North Carolina, South Carolina and West Virginia) have regulations; seven states (Alaska, Arizona, Kentucky, Montana, New Mexico, Rhode Island and South Dakota) have interpretations of the federal/state agreement; and two states (Mississippi and Pennsylvania) have policy memoranda.

The document categorizes each of these states by regulations for minimum message duration (“dwell time”—generally from 4 to 10 seconds, with 6 or 8 seconds most common); maximum interval between messages (typically from 1 to 4 seconds), and spacing (500 feet is most common). It is unclear how up-to-date these regulations are; we were unable to determine the date for this chart or obtain the latest information from the OAAA, which requires paid registration for access.

The Regulation of Signage: Guidelines for Local Regulation of Digital On-Premise Signs, Menelaos Triantafyllou, Alan C. Weinstein, National Signage Research and Education Conference, 2010.

<http://www.thesignagefoundation.org/LinkClick.aspx?fileticket=3inv%2fFyrpFk%3d&tabid=59&mid=468>

From the report: Based on a recent survey of numerous jurisdictions by one of the authors, the most common regulatory provisions applicable to digital on-premise signs appear below:

- Require that the sign display remain static for a minimum of 5-8 seconds and require “instantaneous” change of the display; i.e., no “fading” in/out of the message.
- Prohibit scrolling and animation outside of unique—and mostly pedestrian-oriented—locations.
- Limit brightness to 5,000 nits during daylight and 500 nits at night.
- Require automatic brightness control keyed to ambient light levels.
- Require display to go dark if there is a malfunction.
- Specify distancing requirements from areas zoned for residential use and/or prohibit orientation of sign face towards an area zoned for residential use.

See also Appendices B and C in Research Review of Potential Safety Effects of Electronic Billboards on Driver Attention and Distraction in **Related Research** for an overview of state regulations and practices as of 2001.

Survey of Current State Regulations

We found digital display regulations for 12 states. These regulations are summarized in the following table and then detailed by state.

State	Duration ≥	Inter- val ≤	Brightness/ Illumination	Font Size	Visual Effects	Sequencing	Spacing	Locations	Billboard Size
DE	10s	1s	Must appropriately adjust display brightness as ambient light levels change.	Size not specified. A sign that attempts or appears to attempt to direct the movement of traffic or which contains wording, color, shapes, or likenesses of official traffic control devices is prohibited.	May not contain or display any lights, effects, or messages that flash, move, appear to be animated or to move, scroll, or change in intensity during the fixed display period	Prohibited.	>2,500ft from another VMS >500ft from a static sign	Permitted within 660ft of the edge of the right-of-way of any interstate or federal-aid primary highway. > 1,000ft from an interchange, interstate junction of merging or diverging traffic, or an at-grade intersection. May not be placed along designated Delaware byways.	Not specified.
FL	6s	2s	Lighting which causes glare or impairs the vision of the driver of any motor vehicle, or which otherwise interferes with any driver's operation of a motor vehicle is prohibited. A sign may not be illuminated so that it interferes with the effectiveness of, or obscures, an official traffic sign, signal or device. Lighting may not be added to or increased on a nonconforming sign.	Not specified.	Flashing, intermittent, rotating, or moving lights are prohibited. Instantaneous transition for entire sign face required.	Not specified.	Not specified.	Not specified.	Not specified.

State	Duration ≥	Inter- val ≤	Brightness/ Illumination	Font Size	Visual Effects	Sequencing	Spacing	Locations	Billboard Size
GA	10s	3s	Must be effectively shielded so as to prevent beams or rays of light from being directed at any portion of the traveled way, which beams or rays are of such intensity or brilliance as to cause glare or to impair the vision of the driver of any motor vehicle or which otherwise interfere with the operation of a motor vehicle. Must not obscure or interfere with the effectiveness of an official traffic sign, device, or signal.	Not specified.	May not contain flashing, intermittent, or moving light or lights except those giving public service information such as time, date, temperature, weather.	Not specified.	>5,000ft from another multiple message sign.	Not specified.	Not specified.
IA	8s	1s	The intensity of the illumination may not cause glare or impair the vision of the driver of any motor vehicle or otherwise interferes with any driver's operation of a motor vehicle.	Not specified.	No traveling messages (e.g., moving messages, animated messages, full-motion video, or scrolling text messages) or segmented messages are allowed.	No segmented messages allowed.	>500ft from another LED display facing the same way in cities. >1000ft in rural areas.	Not specified.	Not specified.
KS	8s	2s	Must be effectively shielded so as to prevent beams or rays of light from being directed at any portion	Not specified.	Cannot contain or display flashing, intermittent or moving lights, including	Not specified.	>1000ft from another CMS.	Not specified.	Not specified.

State	Duration ≥	Inter- val ≤	Brightness/ Illumination	Font Size	Visual Effects	Sequencing	Spacing	Locations	Billboard Size
			of the traveled way of any interstate or primary highway and are of such intensity or brilliance as to cause glare or to impair the vision of the driver of any motor vehicle or to otherwise interfere with any driver's operation of a motor vehicle. Must not be so illuminated that they obscure any official traffic sign, device or signal, or imitate or may be confused with any official traffic sign, device or signal.		animated or scrolling advertising.				
MA	10s	0s	Must automatically adjust the intensity of its display according to natural ambient light conditions. May not cause beams or rays of light from being directed at any portion of the traveled way, which beams or rays are of such intensity or brilliance as to cause glare or to impair the vision of the driver of any motor vehicle or otherwise interfere with the operation of a motor	Not specified.	May not contain flashing, intermittent, or moving lights; or display animated, moving video, scrolling advertising; or consist of a static image projected upon a stationary object. May not display illumination that moves, appears to move or changes in intensity during	Not specified.	>500ft from any sign. >2000ft from another off premise electronic sign on the same side of the highway. >1000ft from another off premise electronic sign on the opposite side of the	Not specified.	Not specified.

State	Duration ≥	Inter- val ≤	Brightness/ Illumination	Font Size	Visual Effects	Sequencing	Spacing	Locations	Billboard Size
			vehicle. May not obscure or interfere with the effectiveness of an official traffic sign, device or signal, or cause an undue distraction to the traveling public		the static display period. This does not include changes to a display for time, date and temperature.		highway.		
NY	6s	3s	Not specified.	Not specified.	Not specified.	Not specified.	Not specified.	Not specified.	Not specified.
OH	8s	3s	Not specified.	Not specified.	A multiple message or variable message advertising device shall not be illuminated by flashing, intermittent, or moving lights. No multiple message or variable message advertising device may include any illumination which is flashing, intermittent, or moving when the sign face is in a fixed position.	Not specified.	>1000ft from another MMS.	Not specified.	Not specified.
OR	8s	2s	Must operate at an intensity level of not more than 0.3 foot-candles over ambient light as measured by the distance to the sign	Not specified.	No flashing or varying intensity light; cannot create the appearance of movement.	Not specified.	Not specified.	Not specified.	Not specified.

State	Duration ≥	Inter- val ≤	Brightness/ Illumination	Font Size	Visual Effects	Sequencing	Spacing	Locations	Billboard Size
			depending upon its size (150 feet if the display surface of the sign is 12 feet by 25 feet, 200 feet if the display surface is 10.5 by 36 feet, and 250 feet if the display surface is 14 by 48 feet).						
TN	8s	2s	Not specified.	Not specified.	Video, animation, and continuous scrolling messages are prohibited.	Not specified.	>2000ft from another CMS.	Not specified.	Not specified.
WS	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.	4s	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.	Not specified.	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. 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,	Not specified.	Not specified.	Not specified.	Not specified.

State	Duration ≥	Inter- val ≤	Brightness/ Illumination	Font Size	Visual Effects	Sequencing	Spacing	Locations	Billboard Size
	A one-segment message may remain static on the signboard with no duration limit.				expand or contract, bounce, rotate, spin, twist, or otherwise portray graphics or animation as it moves onto, is displayed on, or leaves the signboard.				
WI	6s	1s	No variable message sign lamp may be illuminated to a degree of brightness that is greater than necessary for adequate visibility.	Not specified.	No flashing, intermittent or moving light. Traveling messages prohibited.	Not specified.	Not specified.	Not specified.	Not specified.

- (B) 200 feet for 10.5'x 36'.
- (C) 250 feet for 14'x 48'.

Tennessee

Control of Outdoor Advertising, Chapter 1680-2-3, Rules of Tennessee Department of Transportation Maintenance Division, Tennessee Department of Transportation, February 2003.

Current regulations do not include electronic billboards:

<http://www.tdot.state.tn.us/environment/beautification/pdf/1680-02-03.pdf>.

However, proposed revisions are under review that include guidance on digital displays:

<http://www.tdot.state.tn.us/environment/beautification/docs/Revised-ODA-Rules-Redline.pdf>.

From the web site:

1680-10-01-.03 CRITERIA FOR THE CONTROL OF OUTDOOR ADVERTISING DEVICES.

4. Spacing

(i) (IV) The minimum spacing for changeable message signs with a digital display is two thousand (2,000) feet, except as follows:

- I. An outdoor advertising device that uses a digital display which does not exceed one hundred (100) square feet in total area to give public information such as time, date, temperature, or weather, or to provide the price of a product, the amount of a lottery prize or similar numerical information supplementing the content of a message otherwise displayed on the sign face shall not be subject to the two thousand (2,000) feet minimum spacing requirement in this item (IV).

5. Changeable Message Signs

Changeable message signs are permissible, subject to the following restrictions: (i) The message display time shall remain static for a minimum of eight (8) seconds with a maximum change time of two (2) seconds. (ii) Video, animation, and continuous scrolling messages are prohibited. (iii) Non-conforming devices shall not be converted to a changeable message sign. (iv) The changeable message sign shall contain a default design that will freeze the sign face to one position if a malfunction occurs. (v) The structure for a changeable message sign may contain sign faces that are in a double-faced, back-to-back, or V-type configuration. (vi) The minimum spacing for changeable message signs with a digital display is as provided in Rule 1680-10-.03(1)(a)4.(i)(IV).

Washington

Highway Advertising Control, M22-95, Washington State Department of Transportation, March 2011.

<http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-95/HighwayAdvertisingControl.pdf>

From the report:

468-66-050 Sign classifications and specific provisions

(3) Type 3 – On-premise signs.

(b) Type 3(b) – Business complex on-premise sign. A Type 3(b) business complex on-premise sign may display the name of a shopping center, mall, or business combination.

- (i) Where a business complex erects a Type 3(b) on-premise sign, the sign structure may display additional individual business signs identifying each of the businesses conducted on the premises. A Type 3(b) on-premise sign structure may also have attached a display area, such as a manually changeable copy panel, reader board, or electronically changeable message center, for advertising on-premise activities and/or presenting public service information.

- (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.
- (h) The act does not regulate Type 3(a), 3(b), 3(c), and 3(d) on-premise signs located along primary system highways inside an incorporated city or town or a commercial or industrial area.

Wisconsin

Control of Outdoor Advertising Along and Visible from Highways on the Interstate and Federal-Aid Primary Systems, Chapter Trans 201, Wisconsin Administrative Code, February 2005.

http://docs.legis.wisconsin.gov/code/admin_code/trans/201.pdf

From the web site:

Trans 201.15 – Electronic signs

- (3) Variable Message Signs.
- (c) No message may be displayed for less than one-half second.
 - (d) No message may be repeated at intervals of less than 2 seconds.
 - (e) No segmented message may last longer than 10 seconds.
 - (f) No traveling message may travel at a rate slower than 16 light columns per second or faster than 32 columns per second.
 - (g) No variable message sign lamp may be illuminated to a degree of brightness that is greater than necessary for adequate visibility.
- (4) Multiple Message Signs.
- (a) The louver rotation time to change a message shall be one second or less.
 - (b) The time a message remains in a fixed position shall be 6 seconds or more.

84.30 Regulation of Outdoor Advertising, Wisconsin Legislative Documents, 2012.

<http://docs.legis.wisconsin.gov/statutes/statutes/84/30>

From the web site:

- (3)(c)(1) Signs that contain, include or are illuminated by any flashing, intermittent or moving light or lights are prohibited, except electronic signs permitted by rule of the department.

(4)(bm) Signs may contain multiple or variable messages, including messages on louvers that are rotated and messages formed solely by use of lights or other electronic or digital displays, that may be changed by any electronic process, subject to all of the following restrictions:

1. Each change of message shall be accomplished in one second or less.
2. Each message shall remain in a fixed position for at least 6 seconds.
3. The use of traveling messages or segmented messages is prohibited.
4. The department, by rule, may prohibit or establish restrictions on the illumination of messages to a degree of brightness that is greater than necessary for adequate visibility.

APPENDIX

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

No changeable message signs allowed:	Tri- action Only	Changeable Message /Digital Technology
(3 STATES) ND, NH, WY	(5 STATES) MD, MA, OR, TX, WA,	(38 STATES) AL, AR, AZ, CA, CO, CT DE, FL, GA, ID, IL, IA, IN, KS, KY, LA, MI, MN, MO, MS, MT, NE, NV, NJ, NM, NY, NC, OH, OK, PA, RI, SC, SD, TN, UT, VA, WV, WI

State-by-state breakdown of the 38 states allowing Changeable Message/Digital technology

- States which have statutes (19):

CA, CO, CT, DE, FL
GA, IN, KS, MI, MO
MN, NJ, NY, OH
OK, UT, TN, VA, WI

- Regulations (10):

AR, ID, IL, IA*, LA, NE,
NV, NC, SC, WV

- States with interpretations of the federal/state agreement (7):

AL, AZ, KY, MT,
NM, RI, SD

- Policy memoranda (2):

MS approved a policy DOT memorandum
PA approved the technology through an internal PENNDOT memorandum (2002)
IA* regulations are undergoing a comment period

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, VA
<u>5 seconds</u>	NM, PA
<u>6 seconds</u>	AL, AZ, CT, FL, GA, IA, MI, MN, NV, NY, SD, WI, RI (average)
<u>8 seconds</u>	AR, ID, IN, KS, LA, MO, MS, NJ, NC, OH, OK, OR, SC, TN, UT, WV, WA
<u>10 seconds</u>	DE, IL, 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/Digital Technology

<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	1500 feet
AZ	6 seconds	1 second	*
CA	4 seconds	4 seconds	1000 feet
CO	4 seconds	1 second	1000 feet
CT	6 seconds	3 seconds	*
DE	10 seconds	1 second	2500 feet
FL	6 seconds	2 seconds	1000 to 1500 feet
GA	10 seconds	2 seconds	5000 feet

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>
ID	8 seconds	2 seconds	*
IL	10 seconds	3 seconds	*
IN	8 seconds	2 seconds	*
IA	6 seconds	1 second	*
KS	8 seconds	2 seconds	1000 feet
KY <u>At discretion of state DOT</u>			
LA	8 seconds	4 seconds	*
MI	6 seconds	1 second	*
MN	6 seconds	none	*
MS	8 seconds	instantaneous	*
MO	8 seconds	2 seconds	1400 feet
MT <u>At discretion of state DOT</u>			
NE	10 seconds	2 seconds	5000 feet
NV	6 seconds	3 seconds	*
*NJ <u>(regulatory change pending)</u>	8 seconds	1 second	3000 feet
NM <u>Company discretion</u>	5 seconds	1-2 seconds	*
NY	6 seconds	3 seconds	*
NC	8 seconds	2 seconds	1000 feet
OH	8 seconds	3 seconds	1000 feet
OK	8 seconds	4 seconds	*

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>
PA	5 seconds	1 second	*
RI	5-7 seconds	2-3 seconds	*
SD	6 seconds	none	*
SC	8 seconds	2-3 seconds	*
TN	8 seconds	2 seconds	2000 feet
UT	8 seconds	3 seconds	*
VA	4 seconds	none	*
WV	8 seconds	2 seconds	1500 feet
WI	6 seconds	1 second	*

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	*
WA	8 seconds	4 seconds	*

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WAC 468-66-050**Sign classifications and specific provisions.**

Signs shall be classified and restricted to the provisions following:

(1) Type 1 - Directional or other official signs and notices. Directional or other official signs and notices may be erected and maintained on private property or public property, other than state highway right of way, for the purposes of carrying out an official duty or responsibility. The signs may only be installed by public offices or public agencies within their territorial or zoning jurisdiction and shall follow federal, state, or local law.

(a) Type 1(a) - Directional sign. A directional sign may only be installed in accordance with the provisions following:

(i) Publicly or privately owned places - Directional signs for publicly or privately owned places that feature natural phenomena; historical, cultural, scientific, or educational opportunities; areas of scenic beauty, or outdoor recreation areas:

- Publicly owned places - Directional signs for public places owned or operated by federal, state, or local government, or their agencies;
- Privately owned places - Directional signs for nonprofit privately owned places that feature scenic attractions. The attractions must be nationally or regionally known, or of outstanding interest to travelers.

(ii) A sign message shall be limited to identification of the activity or attraction and directional information. Directional information is limited to that which helps the motorist locate the activity, such as providing mileage to the activity, highway route or exit numbers.

(iii) Descriptive words, phrases, and photographic or pictorial representations of the activity or attraction are prohibited.

(iv) Type 1(a) signs shall not exceed twenty feet in length, width, or height, or one hundred fifty square feet in area, including border and trim but excluding supports.

(v) The department must approve the proposed installation location.

(vi) Along the interstate system and other limited access highways having grade separations (interchanges), a sign shall not be located within two thousand feet of an interchange or rest area, measured from the ramp physical gore, or within two thousand feet of a parkland or scenic area.

(vii) Type 1(a) signs shall not be spaced closer than one mile apart.

(viii) Visible to a state route approaching an activity or attraction, a maximum of three signs per direction of travel are allowed for each activity or attraction.

(ix) Type 1(a) signs located along the interstate system shall be within seventy-five air miles of the activity or attraction.

(x) Type 1(a) signs located along the primary and scenic systems shall be within fifty air miles of the activity or attraction.

(b) Type 1(b) - Official sign. An official sign may be installed subject to the provisions following:

(i) Type 1(b) signs may only be erected and maintained by public offices or public agencies.

(ii) Type 1(b) signs may only be located within the governing jurisdiction of the public office or public agency.

(iii) Type 1(b) signs shall follow federal, state, or local law.

(iv) Type 1(b) sign message content is limited to providing information that furthers an official duty or responsibility.

(v) Type 1(b) signs shall not exceed twenty feet in length, width, or height, or one hundred fifty square feet in area, including border and trim but excluding supports.

(vi) Type 1(b) signs may be historical markers authorized by federal, state, and local law.

(vii) Type 1(b) signs are not regulated by the act with regard to visibility to highways, zoning requirements, number of signs, or spacing.

(c) Type 1(c) - Service activity sign. A service activity sign may be installed subject to the provisions following:

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(i) Type 1(c) signs shall contain only the name of a nonprofit organization, its address, and the time of its meeting or service.

(ii) Type 1(c) signs shall not exceed eight square feet in area.

(iii) Type 1(c) signs are not regulated by the act with regard to visibility to highways, zoning requirements, number of signs, or spacing.

(2) Type 2 - For sale or lease sign. A Type 2 sign may only advertise the sale or lease of the parcel of real property upon which the sign is located. The name of the owner of the property offered for sale or lease, or the owner's agent and phone number shall not be displayed more conspicuously than the words "for sale" or "for lease." No other message may be displayed on the sign.

(a) Type 2 signs shall not exceed twenty feet in length, width, or height, or one hundred fifty square feet in area, including border and trim but excluding supports.

(b) Not more than one Type 2 sign may be installed that is visible to traffic proceeding in any one direction on an interstate, primary, or scenic system highway.

(c) The act does not regulate Type 2 signs with regard to zoning requirements or spacing.

(3) Type 3 - On-premise signs.

(a) Type 3(a) - On-premise sign. A Type 3(a) on-premise sign may only advertise an activity conducted on the property upon which the sign is located.

(i) A Type 3(a) on-premise sign shall be limited to advertising the business or the owner, or the products or services offered on the property. A sign consisting mainly of a brand name, trade name, product or service incidental to the main products or services offered on the property, or a sign bringing rental income to the property, is not an on-premise sign.

(ii) A Type 3(a) on-premise sign more than fifty feet from the advertised activity may not exceed twenty feet in length, width, or height, or one hundred fifty square feet in area, including border and trim but excluding supports. The act does not regulate the size of Type 3(a) on-premise signs located within fifty feet of the advertised activity.

(iii) A Type 3(a) on-premise sign located at a shopping center, mall, or business combination is not authorized more than fifty feet from the individual activity it advertises, unless it is installed together with a Type 3(b) business complex on-premise sign as described in (b)(i) of this subsection.

(b) Type 3(b) - Business complex on-premise sign. A Type 3(b) business complex on-premise sign may display the name of a shopping center, mall, or business combination.

(i) Where a business complex erects a Type 3(b) on-premise sign, the sign structure may display additional individual business signs identifying each of the businesses conducted on the premises. A Type 3(b) on-premise sign structure may also have attached a display area, such as a manually changeable copy panel, reader board, or electronically changeable message center, for advertising on-premise activities and/or presenting public service information.

(ii) Type 3(b) on-premise signs are not regulated by the act with regard to size. Any Type 3(a) on-premise sign and any display area, installed together with a Type 3(b) on-premise sign, may not exceed twenty feet in length, width, or height, or one hundred fifty square feet in area, including border and trim.

(c) Type 3(c) - Future site on-premise sign. A Type 3(c) future site on-premise sign may only display the name of a business activity, or other activity of interest to motorists, planned for the property upon which the sign is located and the anticipated opening date of such activity.

(i) The owner, or owner's representative, shall by letter notify the department at least thirty days prior to the installation of the proposed Type 3(c) future site on-premise sign. Said notice shall include the location, sign message, and installation date.

(ii) Type 3(c) future site on-premise signs may remain until the business activity is operational, but shall not exceed one year from the planned installation date. The sign must be removed at the end of one year after the planned installation date if the business activity is not yet operational.

(iii) Type 3(c) future site on-premise signs shall not exceed twenty feet in length, width, or height, or one hundred fifty square feet in area.

(d) Type 3(d) - Temporary political campaign sign. A Type 3(d) temporary political campaign sign may express a property owner's endorsement of a political candidate or ballot issue.

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(i) Type 3(d) temporary political campaign signs are limited to a maximum size of thirty-two square feet.

(ii) Type 3(d) temporary political campaign signs must be removed within ten days after an election.

After primary elections, temporary political campaign signs endorsing a successful candidate may remain up to ten days after the succeeding general election.

(e) Not more than one Type 3(a) or 3(b) sign, visible to traffic proceeding in any one direction on an interstate system highway; on a primary system highway outside an incorporated city or town or commercial or industrial area; or on a scenic system highway, may be permitted more than fifty feet from the advertised activity. Not more than one Type 3(c) sign may be installed visible to traffic proceeding in any one direction on an interstate system highway; on a primary system highway outside an incorporated city or town or commercial or industrial area; or on a scenic system highway. The act does not regulate Type 3(d) signs with regard to the number of signs installed, visibility from highways, zoning requirements, or spacing.

(i) For Type 3(a) on-premise signs, the fifty-foot distance from the advertised activity shall be measured from the sign to the nearest portion of that building, storage, or other structure or processing area, which is the most regularly used and essential to the conduct of the advertised activity as determined solely by the department.

(ii) For Type 3(b) on-premise signs, the fifty-foot distance from the advertised activity may be measured in the same manner as for Type 3(a) on-premise signs, or may be measured fifty feet from the nearest portion of a combined parking area.

(f) A Type 3(a) or 3(b) on-premise sign more than fifty feet from the advertised activity shall not be erected or maintained at a greater distance from the advertised activity than one of the options following, as applicable, selected by the owner of the business being advertised:

(i) One hundred fifty feet measured along the edge of the protected highway from the nearest edge of the main entrance to the activity advertised;

(ii) One hundred fifty feet from any outside wall of the main building of the advertised activity; or

(iii) Fifty feet from any outside edge of a regularly used parking lot maintained by, and contiguous to, the advertised activity.

(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.

(h) The act does not regulate Type 3(a), 3(b), 3(c), and 3(d) on-premise signs located along primary system highways inside an incorporated city or town or a commercial or industrial area.

(4) Type 4 - Off-premise signs; and

(5) Type 5 - Off-premise signs. Type 4 off-premise signs are distinguishable from Type 5 off-premise signs only by message content. Type 4 off-premise sign messages are those that do not qualify as Type 5 sign messages described in (b) of this subsection.

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(a) A Type 4 sign shall be located within twelve air miles of the advertised activity. A Type 4 sign that displays any trade name which refers to or identifies any service rendered or product sold, used, or otherwise handled more than twelve air miles from such sign shall not be permitted unless the name of the advertised activity, which is within twelve air miles of such sign, is displayed as conspicuously as such trade name.

(b) A Type 5 sign displays a message of specific interest to the traveling public. On Type 5 signs, only information about public places operated by federal, state, or local governments, natural phenomena, historic sites, areas of natural scenic beauty or outdoor recreation, and places for lodging, camping, eating, and vehicle service and repair is deemed to be in the specific interest of the traveling public. A trade name is authorized on a Type 5 sign only if it identifies or represents a place of specific interest to the traveling public; or identifies vehicle service, equipment, parts, accessories, fuels, oils, or lubricants being offered for sale at such place. The display of any other trade name is not permitted on Type 5 signs.

(c) Type 4 and Type 5 signs are restricted in size to the following:

(i) Visible to interstate highways, signs may not exceed twenty feet in length, width, or height, or one hundred fifty square feet in area including border and trim but excluding supports.

(ii) Visible to primary highways, the maximum area for any one sign, except as provided in (c)(iii) of this subsection, shall be six hundred seventy-two square feet with a twenty-five-foot maximum height and a fifty-foot maximum length, including the border and trim but excluding the base or apron, supports, and structural members. Cut-outs and extensions may add up to twenty percent of additional sign area.

(iii) Each sign face of a double-faced (flanking and side-by-side) sign may not exceed three hundred twenty-five square feet.

(d) The spacing of Type 4 and Type 5 signs along interstate highways and visible to traffic traveling in one direction shall be restricted as follows:

(i) Type 4 and Type 5 signs visible to traffic approaching an intersection of the main-traveled way of an interstate highway and an exit roadway may not exceed the number following:

Distance from intersection	Number of signs
0 - 2 miles. . . .	0
2 - 5 miles. . . .	6
More than 5 miles. . . .	Average of one sign per mile

The specified distances shall be measured to the nearest point of intersection of the traveled way of the exit roadway and the main-traveled way of the interstate highway.

(ii) Not more than two such signs may be permitted within any mile distance and no such signs may be permitted less than one thousand feet apart.

(iii) Type 1, 2, and 3 signs shall not be considered in determining compliance with the above spacing requirements.

(iv) Type 4 and Type 5 signs may not be permitted adjacent to interstate highway right of way within the limits of an interchange, including its entrance or exit roadways.

(v) Type 4 and Type 5 signs visible to interstate highway traffic, which has passed an entrance roadway, may not be permitted within one thousand feet of the point where the entrance roadway intersects with the interstate highway. The distance shall be measured from the intersection point farthest from the preceding interchange.

(vi) Not more than one Type 4 or Type 5 sign, advertising activities conducted as a single enterprise or giving information about a single place, may be erected or maintained in such manner as to be visible to traffic moving in any one direction on any one interstate highway.

(e) The spacing of Type 4 and Type 5 signs visible to primary highways shall be restricted as follows:

(i) On limited access highways, no two signs may be spaced less than one thousand feet apart, and no sign may be located within three thousand feet of the center of a grade separated interchange, a safety rest area, or an information center, or within one thousand feet of an at-grade intersection. Not more than

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a total of five sign structures may be permitted per mile, including both sides of the highway. Double-faced (flanking or side-by-side) signs are prohibited.

(ii) On nonlimited access highways inside the boundaries of incorporated cities or towns, not more than a total of four sign structures, including both sides of the highway, may be permitted within a space of six hundred sixty feet or between platted intersecting streets or highways. There shall also be a minimum of one hundred feet between sign structures, including both sides of the highway.

(iii) On nonlimited access highways outside the boundaries of incorporated cities or towns, the minimum spacing between sign structures on each side of the highway shall be five hundred feet.

(iv) Back-to-back signs and V-type signs shall be considered one sign structure.

(f) The minimum space between sign structures located on the same side of the highway shall be measured between two points along the nearest edge of pavement. The measurement points are established at the origin of lines extending perpendicular from the edge of pavement to the apparent centers of the sign structures.

(g) The minimum space between sign structures located on opposite sides of the highway shall be measured in the applicable manner following:

(i) Along tangent sections, sign spacing is measured between two points along the edge of pavement in the increasing milepost direction of travel. One measurement point is established at the origin of a line extending perpendicular from the edge of pavement to the apparent center of the sign structure located in the increasing direction of travel. The second measurement point is established at the origin of a line extending perpendicular from the edge of pavement to the apparent center of the sign structure located in the decreasing direction of travel.

(ii) Along horizontal curve sections, sign spacing is measured between two points on the edge of pavement along the arc on the inside of the curve. One measurement point is established at the origin of a line extending perpendicular from the edge of pavement to the apparent center of the sign structure located along the highway in the increasing milepost direction of travel. The second measurement point is established at the origin of a line extending perpendicular from the edge of pavement to the apparent center of the sign structure located along the highway in the decreasing milepost direction of travel.

(h) Type 1, 2, 3, 7, and 8 signs shall not be considered in determining compliance with the above spacing requirements.

(i) Type 4 and Type 5 signs may be permitted within commercial and industrial areas adjacent to interstate and primary highways, provided that spacing is available as specified in (d) and (e) of this subsection.

(j) Type 4 and Type 5 signs are not permitted visible to the scenic system.

(k) Pursuant to the 1991 Intermodal Surface Transportation Efficiency Act, a National Scenic Byway Demonstration Project is established on State Route 101, from the Astoria/Megler Bridge to Fowler Street in Raymond and from the junction with State Route 109 near Queets to the junction with State Route 5 near Olympia. No new Type 4 or Type 5 signs may be permitted within the limits of this project. Type 4 or Type 5 signs installed prior to July 25, 1993, may remain as nonconforming signs.

(6) Type 6 - Landmark signs.

(a) Type 6 signs shall have been lawfully in existence on October 22, 1965, and have historic or artistic significance, including signs on farm structures or natural surfaces.

(b) Historic or artistic significance shall be determined by the department and approved by the Federal Highway Administration.

(c) Within the limits of the National Scenic Byway Demonstration Project identified in (5)(h) of this subsection, Type 6 signs may remain as nonconforming signs.

(7) Type 7 - Public service signs located on school bus stop shelters. Type 7 signs may display safety slogans or messages, and identify the donor, sponsor, or contributor of a school bus stop shelter. No other message(s) may be displayed.

(a) Safety slogans or messages must occupy at least sixty percent of the sign area, and appear more predominant than the name of the donor, sponsor, or contributor.

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(b) Type 7 signs may be located on school bus stop shelters only as authorized or approved by state law or regulation, or city or county ordinance or resolution, and may be installed visible to primary and scenic system highways.

(c) Type 7 signs may not exceed thirty-two square feet. A sign shall not protrude above the roofline or beyond the sides of the school bus stop shelter.

(d) Not more than one sign on each shelter may face in any one direction.

(e) The act does not regulate Type 7 signs with regard to zoning requirements or spacing between Type 7 signs and other types of signs.

(8) Type 8 - Temporary agricultural directional signs. Type 8 signs provide directional information to places of business having seasonal agricultural products for sale.

(a) Type 8 signs may display the business name, product(s) for sale, travel direction, and travel distance to the nearest mile from the state highway to the business.

(b) Type 8 signs may not exceed thirty-two square feet.

(c) There shall be at least three hundred feet spacing between Type 8 signs.

(d) Not more than two signs advertising a place of temporary agricultural business may be installed visible to traffic proceeding in one direction of travel on any one state route.

(e) Premises on which the seasonal agricultural products are sold must be within fifteen air miles of the state highway.

(f) Type 8 signs may be posted only during the period of time the seasonal agricultural product(s) is being sold.

(g) Any necessary supplemental follow-through signs along city streets or county roads must be installed before the Type 8 signs may be installed visible to the state highway.

(h) The signs may be installed visible to primary system highways outside incorporated cities or towns, and scenic system highways.

(i) Type 8 signs may not be installed visible to interstate highways, including interstate highways that are also part of the scenic system, or visible to primary system highways within incorporated cities or towns.

(j) The act does not regulate Type 8 signs with regard to zoning requirements or spacing between Type 8 signs and other types of signs.

[Statutory Authority: RCW 47.42.120. WSR 14-22-055, § 468-66-050, filed 10/30/14, effective 11/30/14. Statutory Authority: Chapter 47.42 RCW and Title 23 Code of Federal Regulations part 750. WSR 06-03-005, § 468-66-050, filed 1/4/06, effective 2/4/06. Statutory Authority: Chapter 34.05 RCW and RCW 47.42.060. WSR 99-24-083 (Order 195), § 468-66-050, filed 11/30/99, effective 12/31/99. Statutory Authority: Chapter 47.42 RCW and RCW 47.01.101(5). WSR 94-12-049 (Order 144), § 468-66-050, filed 5/27/94, effective 6/27/94. Statutory Authority: RCW 47.42.060. WSR 88-22-002 (Order 116), § 468-66-050, filed 10/20/88. Statutory Authority: Chapter 47.42 RCW. WSR 85-17-012 (Order 96), § 468-66-050, filed 8/12/85. Statutory Authority: RCW 47.42.060. WSR 80-05-055 (Order 55), § 468-66-050, filed 4/18/80. Statutory Authority: 1977 ex.s. c 151. WSR 79-01-033 (DOT Order 10 and Comm. Order 1, Resolution No. 13), § 468-66-050, filed 12/20/78. Formerly WAC 252-40-040.]



Outdoor Advertising Association of America

Issue Briefs

Outdoor Lighting and Dark Skies

Message Points

- Illumination is fundamental to effective outdoor advertising, a round-the-clock mass communication medium
- Unreasonable limits on lighting hurt the traveling public, advertisers and public safety
- Billboard lighting is a tiny fraction of the overall ambient light level

In a mobile society, outdoor lighting is an essential part of commerce and security. Anti-lighting proponents seek to damage the effectiveness of illuminated outdoor advertising by placing arbitrary lighting limits. Restrictions on lighting undermine the business of outdoor advertising by requiring costly retro-fitting of sign structures or elimination of lighting fixtures.

Lighting on outdoor advertising structures is a tiny fraction of the overall ambient light level. A previous report by Lighting Sciences, Inc. concludes that most sky glow – some 96 percent – is produced by sources other than billboards. A summary of this report is enclosed as a reference.

Plus, a new generation of halogen lights is more efficient, requiring only two fixtures to illuminate a standard bulletin (14-by-48 foot billboard) rather than three or four fixtures. These new fixtures also direct the light more evenly onto the face of the bulletins, reducing ambient light spillage around a bulletin edges and also cutting energy consumption.

Digital Billboards

Based on a March, 2008, report by Lighting Sciences, Inc, Phoenix, AZ, the OAAA has recommended brightness criteria for digital billboards, suggesting that light produced by digital billboard structures should not exceed 0.3 footcandles over ambient light levels. Eight states have adopted this standard. Using the industry standard of 0.3 footcandles over ambient light levels, provides reasonable, objective method to a achieve a site specific lighting requirement for digital billboards.

States with 0.3 foot candle criteria include:

- Colorado: 0.3 foot candles over ambient lighting levels*
- Massachusetts: 0.3 foot candles over ambient lighting levels
- Michigan: 0.3 foot candles over ambient lighting levels
- New Mexico: 0.3 foot candles over ambient lighting levels
- Oregon: 0.3 foot candles over ambient lighting levels
- Puerto Rico: 0.3 foot candles over ambient lighting levels
- Tennessee: 0.3 foot candles over ambient lighting levels
- Wyoming: 0.3 foot candles over ambient lighting levels

*(includes a back-up measurement of 300 Nits at night)

States with Candelas/Square meter (Nits) criteria or have proposed criteria include:

- West Virginia: candelas per square foot (note, not a nit), as follows:

Candelas/Sq Ft	Day	Night
Red	300	100
Green	600	200
Amber	450	150
Blue	800	350
White	550	50
All Color	650	250

- Arizona: 342 nits at night
- Missouri: 300 nits at night

States with Custom Criteria:

- Delaware: no maximum brightness level, but sign must adjust to ambient light changes
- Illinois: No brightness standards, but a letter from the manufacturer discussing the malfunction mechanism and hold time is required
- Mississippi: Sign must have “capability to adjust its intensity in response to ambient lighting conditions”

Light equals security

Illumination enhances public safety and security. Lack of adequate lighting can compromise safety, promote criminal activity, damage consumer confidence, and depress nighttime commerce.

State legislatures have rejected lighting restrictions

Numerous law-making bodies have considered, but rejected these proposals. (Michigan, Montana, Oregon, Washington, and Wyoming).

In 1999, New Mexico enacted the Night Sky Protection Act, which sought to strike a balance of preserving and enhancing the state's dark sky while promoting safety, security, and conserving energy. The Act exempts outdoor lighting fixtures on advertisement signs on interstates and federal-aid primary highways, as well as other lighting such as navigational lighting systems at airports.

References

OAAA Recommended Brightness Guidelines, based on a report from Dr. Ian Lewin, Principle, Lighting Sciences Incorporated, Scottsdale, AZ, March, 2008

“General Outdoor Advertising Lighting Guidelines,” Illuminating Engineering Society of North America (IESNA), 2003

“A Preliminary Estimation of the Impact of Billboard Lighting on Sky Glow,” *Executive Summary*, Ian Lewin, Ph.D, FIES, L.C., Lighting Sciences Inc., Phoenix, AZ

New Mexico Night Sky Protection Act, 1999

OAAA Recommended Brightness Guidelines

A. OAAA Guidelines: The OAAA recommended brightness criteria for digital billboards is as follows:

- Light produced by a digital billboard should not exceed 0.3 Footcandles over ambient light levels.
- Measurement should be taken utilizing a Footcandle meter from the following distances (perpendicular to the face of the digital billboard):
 - Posters: 150 feet □ 10'6x36 Bulletins: 200 feet
 - 14x48 Bulletins: 250 feet □ 20x60 Bulletins: 350 feet

The measurement distances are based on the average minimum viewing distances for each type of billboard.

- Digital billboards must have automatic dimming capability.

B. Basis for the Guidelines. These guidelines are based on recommendations by Dr. Ian Lewin of Lighting Sciences Inc. (Scottsdale, AZ) in a March, 2008 report to the OAAA. Dr. Lewin developed brightness criteria to meet the following general guidelines:

- Appropriately Legible Copy. Digital advertising copy is appropriately legible and not overly bright.
- Simplicity. Provide a guideline that can be easily implemented and enforced. Measurement of the ambient light level of the sign on and off is conducted by a footcandle meter. If the difference in measurements is less than 0.3 footcandles, the digital billboard is in compliance.
- Established Guidelines. The criteria is based on established scientific methodology and established industry standards from the Illuminating Engineering Society of North America (IESNA) publication TM-11-00 "light trespass" theory which is an accepted standard in the lighting industry.
- Flexibility. Ensure proper brightness levels in a variety of lighting environments.

C. Additional Issues/Clarification

- **Automatic Dimming Capability.** A digital billboard must be able to automatically adjust as ambient light levels change. An automatic light sensing device (such as photocell or similar technology) should be utilized for adjusting the digital billboard's brightness. Sunset-sunrise tables and manual methods of controlling brightness are not acceptable as a primary means of controlling brightness.
- **Brightness Measurement Methodology.** The brightness standard requires the use of a Footcandle meter (also known as a "Lux meter"; ~\$100-1000). A Footcandle meter measures the amount of light arriving at the meter (illuminance), as opposed to an absolute measurement of the amount of light emanating from a light source or light sources (luminance). A Footcandle is a measure of lumens (light rays) that fall on one square foot area; Lux is the metric equivalent of a Footcandle.

- In contrast, a Candela Meter / NIT Gun (~\$3,000) measures the amount of light emanating from a specific light source (luminance). A NIT gun measures candelas (a measure of luminance or brightness) per meter squared (also known as “NITS”), which is a measure of the brightness emanating from a specific light source. It excludes ambient light (which may include light from many sources) from the measurement. Standard NIT levels and/or utilization of a NIT gun are not a part of the OAAA recommended brightness guideline.

General Outdoor Advertising Lighting Guidelines referenced by the Illuminating Engineering Society of North America (IESNA)

A billboard can be illuminated either by fixtures located in front of the sign (front lit), from behind the sign (back lit) or from fixtures mounted away from the sign (remote). Each mounting location will present different issues:

Front lit / Top Mount

- May increase installation cost due to need for additional structure elements.
- Orientation of the fixture may create veiling glare and direct glare to the viewer.
- May possibly reduce the sky glow.
- Increased maintenance cost.
- Location interferes with changing of the sign message.
- Interferes with use of embellishments or cutouts.
- Daytime shadowing will detract from the readability of the sign.

Front lit / Bottom Mount

- Ability to mount fixtures to catwalks eases maintenance.
- Properly designed optical system will minimize sky glow.
- Does not interfere with changing of the sign message.
- Does not interfere with the use of embellishments.
- No daytime shadowing.
- Light source less likely to create veiling glare.

Remote

- Light source able to cover larger sign surface.
- Maintenance may be easier when mounted on the ground.
- May require additional wiring and installation cost.
- May contribute to sky glow.

Back lit

- Requires significantly more luminaires to illuminate the sign.
- Depends on the transmittance characteristics of the vinyl.
- Increase maintenance and installation cost.

- Cost to produce the translucent vinyl media for backlight signs may be more expensive than traditional methods.
- Lamp sources used are typically less efficient and consume more energy.
- Sign face brightness depends on the transmittance characteristics of the vinyl or other face material.

The vast majority of outdoor advertising signs use a front-lit configuration. The proper position of the luminaire (either top or bottom) is greatly determined by the associated costs of owning and operating the billboard. The current standard light fixture for a billboard needs to be mounted 4 to 6 feet out and 1 to 3 feet above or below the display face and is designed to be mounted on 1-1/4" rigid conduit. (The differences in distance have to do with the size of the display area.) The use of catwalks to provide safety to the crew responsible to perform placement and removal of advertisements affords the billboard company a secure structural mounting location. These catwalks are, by need, 3 to 4 feet wide. The fixture is mounted just below the catwalk so that it does not interfere with the worker's movement in front of the billboard. This arrangement also serves to further support and brace the luminaires to hold them in proper positioning. All electrical gear is integral to the fixture thereby providing for ease of installation and maintenance.

The following points explain further the pros/cons of mounting of fixtures on signs.

The current design of the billboard structure does not provide a similar mounting method if the fixtures were to be mounted on top of the billboard. When the fixtures are placed on top of the display area a new set of engineering issues are created. Since there is no catwalk above the sign the light fixtures must be supported by another means. However the conduit is mounted to the structure it must be able to support the weight of the fixture on an arm that is long enough to position the fixture in its proper location (above and in front of the sign face). In this application the amount of weight placed on the base of the conduit would run from 192 lbs to 288 lbs. The inherent vibration of the structure from any wind movement will increase substantially the deflection of the fixture creating a "live load." This will multiply the load on the conduit by a factor of 50%. This increase in weight and stress will accelerate the metal fatigue and may more frequently result in failure.

Another issue that must be taken into consideration when placing luminaires is the use of embellishments. The embellishment, or cutout, most always used at the top of the billboard, may extend the graphic surface up to an additional 4 to 5 feet. The use of top mounted lights will be in direct conflict whenever trying to use embellishments.

The location of the luminaires will also impact the ability of the outdoor company to change the messages on the sign. Traditionally, the sign message is "rolled" across the sign face. The ability of the installers to

perform this task quickly and safely (on signs that could be up to 150' in the air) will be hindered if fixtures and/or additional hardware are positioned at the top of the sign.

The presence of overhead lighting will also create a shadow on the sign during daylight hours. This shadowing will detract from the message and therefore diminish the economic value the sign offers to the customer.

A top mounted fixture will also increase costs of operation due to servicing issues. The fixture can either be installed on a retractable arm or installed on a permanent basis. The first method increases installation costs substantially while the second suffers from the challenges mentioned in the switching of the message and the proper support of the luminaires. In some instances, such as a remote location that does not provide access, a bucket truck may not be able to gain access to the permanent top mount fixture. Changing any of the components becomes a safety issue. The traditional location of the fixture allows for maintenance to be performed without increase risk to the installer as well as no additional costs in equipment by the owner. Any other method will increase operating costs and therefore cost to the consumer.

Types of luminaires

When choosing the type of fixture to use for billboard lighting it is important to understand the performance features of the type of fixtures available. The ability to control light is accomplished by the types of reflectors and refractors used.

A Preliminary Estimation of the Impact of Billboard Lighting on Sky Glow

(Executive Summary), Lighting Sciences Inc., Phoenix, AZ

By Ian Lewin, Ph.D, FIES L.C.

Sky glow is caused by lighting at night entering the atmosphere and being scattered by airborne particles. Sky glow may result from the use of lighting fixtures that emit light above a horizontal plane so that it enters the atmosphere directly. The effect also is caused by light reflecting from lighted objects, such as road surface or a billboard.

This study has evaluated the amount of light entering the atmosphere from a variety of lighting installations. Measured in “sky lumens,” the results allow a comparison to be made of different lighting systems relative to sky glow. Specifically, calculations have been made to compare the sky lumens produced by a typical billboard lighting system to the sky lumens caused by roadway and parking lot lighting.

Various scenarios have been used for the roadway lighting, combining residential and major highway lighting in a typical neighborhood. Areas have been considered that consist only of roadway lighting, as well as areas that contain both roadway and parking lot lighting.

The results of the study support a conclusion that the vast majority of sky glow is a product of urban development. Even where full cut-off fixtures are used on all roadway and parking lot fixtures, and if there is an average of one billboard per square mile, over 96% of the sky glow produced per urban square mile is from those sources and not billboard lighting, for the conditions examined. For the examples considered, a single three fixture billboard lighting systems produces approximately 2 to 3 % of the sky lumens caused by roadway/parking area lighting in a typical one square mile area. For a four fixture billboard lighting system, the range becomes roughly 2.5 to 4 %. These figures can be prorated. For example, if there are two such billboards per square mile, the percentages are doubled; if there is one such billboard per two square miles, the percentages will be halved.

The exact percentages of sky glow are affected by the density of roadways/parking areas, the type of lighting fixtures used and the lighting level provided, among other factors. However, it is apparent that for the scenarios considered, the contribution of billboard lighting to sky glow is small in comparison to that from other sources of lighting. The other sources produce 96 to 98% of sky glow, compared to the 2 to 4 % produced per billboard in the example urban square mile.

Highlights of the New Mexico Night Sky Protection Act

Enacted by the 1999 Legislature and signed into law by Governor Gary Johnson on April 6, 1999, the Night Sky Protection Act regulates outdoor night lighting fixtures to preserve and enhance the state's dark sky while promoting safety, conserving energy and preserving the environment for astronomy. Outdoor lighting fixtures includes permanent or portable outdoor artificial illuminating devices such as searchlights, spot and floodlights, architectural and landscape lighting, parking lot, billboard, and street lighting. In addition to the specific provisions outlined below, the Act specifically prohibits the sale and installation of mercury vapor outdoor lighting fixtures after January 1, 2000.

Provisions of the Night Sky Protection Act will impact night lighting as follows:

MERCURY VAPOR LIGHTING FIXTURES

No new mercury vapor outdoor lighting fixtures shall be sold or installed after January 1, 2000.

SHIELDING OF OUTDOOR LIGHT FIXTURES

All outdoor lighting fixtures installed after January 1, 2000, shall be shielded, except incandescent fixtures of one hundred fifty watts or less and other sources of seventy watts or less.

A shielded light fixture is shielded such that light rays emitted by the fixture, either directly from the lamp or indirectly from the fixture, are projected below a horizontal plane running through the lowest point on the fixture where light is emitted.

NONCONFORMING LIGHT FIXTURES

In addition to other exemptions provided in the Night Sky Protection Act, an outdoor lighting fixture not meeting these provisions shall be allowed if the fixture is extinguished by an automatic shutoff device from 11:00 p.m. to sunrise.

No outdoor recreational facility, whether public or private, shall be illuminated after 11:00 p.m. except for a national or international tournament or to conclude any recreational or sporting event or other activity conducted, which is in progress prior to 11:00 p.m. at a ballpark, outdoor amphitheater, arena or similar facility.

EXEMPTIONS

The following are exempt from the requirements of the Night Sky Protection Act:

1. An outdoor lighting fixture on advertisement signs on interstates and federal primary highways.
2. Outdoor lighting fixtures existing and legally installed prior to the effective date of the Night Sky Protection Act. However, when the existing lighting fixtures become unrepairable, their replacements are subject to all provisions of the Night Sky Protection Act.

3. Navigational lighting systems at airports and other lighting necessary for aircraft safety.

4. Outdoor lighting fixtures are necessary for worker safety at farms, ranches, dairies, feedlots or industrial, mining or oil and gas facilities.

The provisions of the Night Sky Protection Act are cumulative and supplemental and shall not apply within any county or municipality that, by ordinance or resolution, has adopted provisions restricting light pollution that are equal to or more stringent than the provisions of the Night Sky Protection Act.

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► The Oregon Administrative Rules contain OARs filed through November 15, 2016 ◄

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DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION

DIVISION 60

SIGNS

734-060-0000

Outdoor Advertising Sign Application Process

(1) Application forms. An application for a sign permit under the Oregon Motorist Information Act (OMIA) is made by completing and submitting the appropriate form, attaching to the form all documents necessary to show the application meets the requirements of the law, and submitting the correct fee to the Outdoor Advertising Sign Program of the Oregon Department of Transportation. Application forms are available from the Outdoor Advertising Sign Program. There are three different Outdoor Advertising Sign application forms: "Standard Outdoor Advertising Sign Permit Application" for new permits for outdoor advertising signs that preexisted the law change on May 30, 2007, relocations and reconstructions of such permitted signs; "Digital Billboard Outdoor Advertising Sign Application" for digital permits newly issued under ORS 377.710, or relocation and reconstruction of such permitted signs and "Application for Transit Bench or Shelter Sign" for signs on bus/transit benches and bus/transit shelters. The Department may deny a permit application if the applicant does not use the correct form.

(2) Copies of sign laws. The Department will make available copies of all state sign statutes, administrative rules, federal statutes, federal regulations, and federal-state agreements in effect. The Department may charge for the copies at the rate established by law for public records requests, and may require prepayment. The Department may also provide these documents by e-mail, web site, or in other forms for the convenience of the public and the Department.

(3) Summary of regulations. To assist potential permit applicants and the general public, the Department will make available a summary of sign permit regulations. The summary does not bind the Department to the items listed or waive its right and duty to enforce all requirements under the law.

(4) Contents of applications for Standard Outdoor Advertising Signs and Digital Billboard Outdoor Advertising Signs. To be complete the application must include the following.

(a) Application form Part 1: Applicant Information, Sign Specifications. Information must be complete and accurate for applicant, sign builder, purpose of application, description, township/range/section/tax lot, highway route number or name and side of highway, how site is marked, name and address of property owner, and why the sign will be an "outdoor advertising sign." The location boxes should be completed to the best of applicant's ability to enable the Department to find the site.

(b) Application form Part 2: Certification of Applicant. The application form must be signed and dated by the applicant, certifying the information provided by applicant is accurate and has not been changed after the local government certification (see section (c) below). If the applicant is a corporate or other business entity the individual signing must include their title so as to indicate the authority to sign for the applicant.

(c) Application form Part 3: Certification of Local Jurisdiction. After completing Part 1, applicant must submit the complete application to the local jurisdiction for zoning and local compliance information. The local official must complete Part 3 and, if relevant, attach a letter of explanation of local code compliance. The local official must sign and date Part 3. This section does not apply to transit signs.

(d) Fee. The fee is based on square footage as described in OAR 734-059-0100. To be complete applicant must submit the correct application fee. The Sign Program does not accept cash, debit or credit cards; checks must be made out to Oregon Department of Transportation.

(e) Written proof of landowner consent. All applications, except transit sign applications, must include written proof that the landowner consents to have applicant maintain the proposed sign. The document must be signed by the landowner and the application filed during the base term of the agreement, or during a renewal term that is automatic or at applicant's election. If during a renewal period applicant must certify that the renewal was exercised and continues in effect. Examples of acceptable documents are the land lease, land lease plus applicant's certification as described above, land lease plus owner's written confirmation that an extension is being exercised, or a current memo signed and dated by land owner stating that applicant has

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permission to put the sign at the specified location. Payment information need not be included unless it is the evidence that compensation is exchanged making it an outdoor advertising sign.

(f) Business License. The applicant and the sign builder must have a current outdoor advertising sign business license as required under ORS 377.730. It is the responsibility of the Business License holder who erects or maintains an outdoor advertising sign to ensure that the outdoor advertising sign, visible to a state highway, is in compliance with the OMIA. Compliance includes ensuring signs have an active state sign permit prior to placing or maintaining any message on the sign, and ensuring that the sign stays in compliance during the time that the licensee operates or maintains the sign. Violations may result in suspension or revocation of the licensee's business license as allowed under ORS 377.730.

(g) Relocation permit application. For a relocation application, if the zoning was first commercial or industrial after 1/1/1973, or if the local jurisdiction cannot determine the date, the applicant must submit a sketch or other document showing the site is within 750 feet of a commercial or industrial area to comply with ORS 377.767(3).

(h) Pre-existing sign permit application. For an application for a new pre-existing sign under ORS 377.712 the following additional items are required:

(A) Complete the application form "Supplement for Pre-existing Sign Permit" and sign it before a notary public;

(B) Submit documents demonstrating each of your claims, such as a lease showing the sign was posted for compensation; and

(C) Pursuant to ORS 377.712(1), include documentation demonstrating how applicant was ignorant of the permit requirement for outdoor advertising signs as of May 30, 2007.

(5) Digital Billboard applications must also include the following information:

(a) When being reconstructed or relocated for the first time as a digital billboard the applicant must provide the eligible permit(s) or relocation credit(s) being retired pursuant 377.700 to 377.840 and OAR 734-060-0007.

(b) Whether the proposed sign is a "Poster," "Bulletin," or other sign as described in OAR 734-060-0007(2).

(c) Emergency malfunction contact information including name, phone number along with proposed response procedure to possible malfunction.

(d) Whether or not a renewable energy resource is available and being utilized. If none, then the applicant must complete the affidavit attesting that no renewable resource is available.

(6) Transit Bench or Shelter Application. A transit shelter or bus bench application must provide documentation demonstrating that the site is at an official bus or transit stop on a city or urban transit system route.

(7) Complete Applications.

(a) The Outdoor Advertising Sign Program's mailing address is: Oregon Department of Transportation, Right of Way Section — Sign Program, 4040 Fairview Industrial Drive SE, MS #2, Salem OR 97302. The Sign Program receives hand deliveries at 4040 Fairview Industrial Drive SE, Salem Oregon. The Sign Program receives facsimiles at 503-986-3625. The Sign Program receives electronic mail at OutdoorAdvertising@odot.state.or.us.

(b) The Department requires original signatures and original initials to any changes on the application form. Therefore the Department will not accept the application form by electronic transmission (including facsimile). The Department may accept other documents by electronic transmission. The Department will not accept any changes made verbally; all changes must be in writing.

(c) The Department will indicate on each application document the date and time received. Application materials received by mail will be treated as received at the time a representative of the sign program physically receives the program's mail for that day. Application materials received in person, by fax, or by electronic transmission will be treated as received when a representative of the sign program physically receives those materials.

(d) The Department will only process applications that are complete. An application is complete when the Outdoor Advertising Sign program receives the signed application form including all necessary information, all documents necessary for issuance of a permit, and the correct application fee.

(A) Within 15 calendar days of receiving an application the Department will provide to the applicant written notice whether the application is complete. If the Department determines the application is complete, the notice will state the application's priority among all pending, complete applications.

(B) If the Department determines any information provided is incorrect, the application is not complete. The Department may rescind a notice of completeness and priority date if it later

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determines that information provided by applicant is not correct.

(e) If an application is not complete, within 15 calendar days of receiving the application the Department will return the entire application with written instructions on what is needed to complete it. The applicant must initial any subsequent changes and, if the changes are substantive to the local jurisdiction, must obtain a new certification from the local jurisdiction.

(A) If an application form is complete but the application is considered incomplete due to insufficient supporting documents or failure to submit the fee, the Department may return the entire application with written instructions on how to complete it or the Department may hold the application and notify the applicant in writing of what is needed and when it must be provided.

(B) Within 15 days of receiving the corrected form or additional materials the Department will provide the applicant written notification whether the application is complete and, if complete, the priority among all pending, complete applications.

(C) If the applicant makes any change to the application after it is deemed complete, the Department will change the priority date to the date of that change.

(D) If the Department has held an incomplete application for 60 days from the date of initial receipt, the application is deemed withdrawn by the applicant. The Department will return a copy of the application and may refund any eligible deposited fee. The Department will retain the original application for our records.

(8) Processing of complete permit application.

(a) The Department will approve or deny a permit within 60 days of the complete application's priority date as determined under section (7)(d) or (e) of this rule if the application clearly does not conflict with another complete application.

(b) An application for a permit that conflicts with the location of an expired or canceled permit will not be processed until the time for any hearing or appeal on the latter permit has passed, unless the permit is being canceled as a condition for issuance of the new permit.

(c) When a complete application might conflict with another complete application due to spacing or any other reason, the application with the earliest priority date and time takes precedence over later applications. Subject to all other requirements of the OMIA, the Department will issue the permit to the earlier applicant.

(d) If multiple complete applications have the same priority date and time, and are determined by the Department to compete for the same spot, the Department shall notify the applicants of the circumstances within seven days of the Department's determination. If an affected applicant requests a contested case hearing, the matter will be determined by a single contested case hearing under Oregon's Administrative Procedures Act. The Department shall refer the matter to the Office of Administrative Hearings within seven days of an applicant's written hearing request.

(e) If the Department does not approve or deny a permit application within the time allowed under section (8)(a) of this rule, such actions do not require the Department to issue a permit or require any remedy except as provided otherwise in law.

(9) Field checks; applicant requirements and Department method.

(a) When the Department determines an application is complete, the Department will perform a field check to determine the milepoint and all other information necessary to process the application.

(b) The applicant must place a marking at the site to show the proposed location for the sign permit. The applicant may use a stake, ribbon, paint, or any method or material that will allow the Department to easily locate the site and attribute it to the applicant. If the marked site is other than that represented to the local authority in obtaining its signature on the application form, or is other than where the applicant actually builds the sign, the Department may consider that a violation of ORS 377.725(10).

(c) If the Department cannot locate the site it will notify the applicant pursuant to (5)(e) above that the application is incomplete due to incorrect information and may request reasonable action by the applicant to identify the site.

(d) The Department will conduct a field check by traveling to the proposed site and calculating the milepoint to the one-hundredth of a mile or, when necessary, to the one-thousandth of a mile. The Department may also determine the engineering station. The Department may also make any other determination regarding the site that is relevant to the application, such as proximity to the right of way and to a commercial or industrial area. Once a field check has been conducted the application fee is non-refundable.

(e) The Department may use intersections, highway structures, or other highway feature and its corresponding milepoint or engineering station, to measure and calculate the milepoint of the proposed site. Milepost markers are for the convenience of motorists and are not precise indications of the milepoint, therefore the Department will not use milepost markers for these calculations without other indication of accuracy.

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(10) Denied Permit Applications. If the Department denies an application, it will consider that site as conflicting with other applications:

- (a) Until the time to request a hearing elapses without a hearing request from the applicant; or
- (b) If a hearing is requested, until the time to request an appeal on the final order has elapsed or until the final appellate court enters a judgment on the matter, whichever is later.
- (c) The Department will keep the original application and any accompanying documents and return a copy after an application is denied.

(11) Issued Permits.

- (a) The permit will specify the 180th day by which the sign must be constructed.
- (b) Within 190 days of permit issuance, the permittee must notify the Department in writing if the action described in the permit has been completed, and include at least one photograph demonstrating that completion. For a reconstruction permit or a relocation permit based on a relocation credit, the notice must state that the new sign has been constructed. For a direct relocation the notice must state that the new sign has been constructed and the former sign on which the permit was based has been removed. If the Department has not received the notification within 180 days the Department will alert the permittee about the upcoming 190-day deadline. If the permittee fails to submit the written notice and photograph within the time allowed, the Department will cancel the permit to relocate or reconstruct, and the permit will revert to its prior status. No fees will be refunded.

(c) "Constructed" means that the structure and all sign faces are permanently in place and the permit plate is attached. "Removed" means the taking down, removing, or eliminating all sign structure elements that are visible from the state right of way

Stat. Auth.: ORS 184.616, 184.619, 377.715, 377.725

Stats. Implemented: ORS 377.715, 377.725

Hist.: HWD 2-2009, f. 3-20-09, cert. ef. 3-23-09; HWD 9-2011(Temp), f. 8-24-11, cert. ef. 9-29-11 thru 3-26-12; HWD 6-2012, f. & cert. ef. 3-26-12; HWD 11-2014, f. & cert. ef. 12-19-14

734-060-0007

Digital Billboard Procedures

(1) This rule describes the process for applying for a permit for a digital billboard.

(2) Definitions for the purposes of this rule:

- (a) "Sign" means the sign structure, the display surfaces of the sign, and all other component parts of the sign.
- (b) "Retire" means to use a relocation credit such that it no longer exists or to remove an existing sign to become a relocation permit or credit for use.
- (c) "Bulletin" means an outdoor advertising sign with a display surface that is 14 feet by 48 feet.
- (d) "Poster" means an outdoor advertising sign with a display surface that is 12 feet by 25 feet.
- (e) "Digital Billboard" means an outdoor advertising sign that is static and changes messages by any electronic process or remote control, provided that the change from one message to another message is no more frequent than once every eight seconds and the actual change process is accomplished in two seconds or less.

(3) Qualifications for receiving a digital billboard state sign permit:

(a) The proposed site and digital billboard must meet all requirements of the OMIA including, but not limited to, the following:

- (A) The digital billboard is not illuminated by a flashing or varying intensity light.
- (B) The display surface of the digital billboard does not create the appearance of movement.
- (C) The digital billboard must operate at an intensity level of not more than 0.3 foot-candles over ambient light as measured by the distance to the sign depending upon its size.
- (D) The distance measurement for ambient light is: 150 feet if the display surface of the sign is 12 feet by 25 feet, 200 feet if the display surface is 10.5 by 36 feet, and 250 feet if the display surface is 14 by 48 feet.

(b) Applicant must submit a completed application for a digital billboard state sign permit using the approved form that may be obtained by one of the following methods:

- (A) Requesting from Sign Program Staff by phone at 503-986-3650;
- (B) Email: OutdoorAdvertising@odot.state.or.us;

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(C) Website: <http://www.oregon.gov/ODOT/HWY/SIGNPROGRAM/pages/index.aspx>.

(c) The Department shall confirm that any existing permitted Outdoor Advertising Sign or relocation credit being retired for the purpose of receiving a new digital billboard state sign permit has been removed within the 180 days allowed to construct the new permitted sign. The Department will not charge a Banking Permit Fee for the cancellation of state sign permits retired for the purpose of receiving a new digital billboard permit.

(4) This section sets forth the criteria for determining the required relocation credits or existing permitted signs that an applicant shall retire to receive one new digital billboard state sign permit:

(a) Applicants who own 10% or less of all active relocation credits at the time the application is submitted shall either remove one existing state permitted outdoor advertising sign with a display area of at least 250 square feet or provide one active relocation credit of at least 250 square feet and retire that permit. Applicants meeting these criteria are not limited to either "Bulletin" or "Poster" billboards.

(b) Applicants who own more than 10% of all active relocations credits shall apply for a new digital billboard state sign permit as follows:

(A) For a digital billboard that is intended to be a bulletin, the applicant has three options:

(i) Remove two existing bulletins, retire the permits for those signs, and retire three relocation credits; or

(ii) Remove one existing bulletin and two existing posters, retire those permits and retire three active relocation credits; or

(iii) Remove four existing posters, retire the permits for those signs, and retire three relocation credits.

(B) For a digital billboard that is intended to be a poster, the applicant has two options:

(i) Remove two existing posters, retire the permits for those signs, and retire three relocation credits;

(ii) Remove one existing bulletin, retire the permit for that sign, and retire three relocation credits.

(c) For an active relocation credit to be eligible it must be at least 250 square feet. All permits and relocation credits submitted under these procedures will be permanently cancelled and are not eligible for renewal.

(d) Any state sign permits submitted for retirement must include the written statement notifying the Department that the "lease has been lost or cancelled."

(5) The Department will determine the percentage of relocation credits owned by an applicant by dividing the total number of unused relocation credits by the total number of unused relocation credits owned by the applicant on the day the application is received.

(6) Two digital billboard state sign permits are required for any back to back or V-type digital sign. A separate application is required for each digital sign face.

(7) The first time a digital billboard is permitted it is not subject to the 100-mile rule in ORS 377.767(4). The site of the newly permitted billboard will become the established location for future reference.

(8) Relocation of permitted digital billboards. The Department will issue one digital relocation credit for each permitted digital sign that is removed. The digital relocation credit issued will be for the same square footage as the permitted digital sign that was removed. A digital relocation credit can only be used to relocate a digital billboard. A permitted digital sign can only be reconstructed as a digital billboard.

(9) Use of renewable energy resource. The applicant must provide a statement with the application that clarifies what, if any, renewable energy resources are available at the site and are being utilized. If none, then a notarized statement to that effect must be included with the application.

(10) All permitted digital billboards must have the capacity to either freeze in a static position or display a black screen in the event of a malfunction.

(a) The applicant must provide emergency contact information that has the ability and authority to make modifications to the display and lighting levels in the event of emergencies or a malfunction.

(b) The Department will notify the sign owner of a malfunction that has been confirmed by ODOT in the following instances:

(A) The light impairs the vision of a driver of any motor vehicle; or

(B) The message is in violation of ORS 377.710(6) or 377.720(3)(d).

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(11) All digital billboard signs must comply with the light intensity and sensor requirements of ORS 377.720(3)(d).

(a) The Department will take measurements of the permitted digital billboard when notified that the sign has been constructed and the permit plate has been installed.

(b) The Department will use an approved luminance meter designed for use in measuring the amount of light emitted from digital billboards using the industry standard for size and distance as follows:

(A) 150 feet for 12'x 25.'

(B) 200 feet for 10.5'x 36'.

(C) 250 feet for 14'x 48'.

Stat. Auth.: ORS 184.616, 184.619, 377.710, 377.729, 377.753

Stats. Implemented: ORS 377.710, 377.720, 377.750, 377.767

Hist.: HWD 9-2011(Temp), f. 8-24-11, cert. ef. 9-29-11 thru 3-26-12; HWD 6-2012, f. & cert. ef. 3-26-12; HWD 11-2014, f. & cert. ef. 12-19-14

734-060-0010

Criteria for Issuance of New Permits for Benches Utilized as Outdoor Advertising Signs

(1) New permits may be issued for a bus or transit bench utilized for an outdoor advertising sign (bench signs) and such signs may only be erected after a permit has been obtained from the Department of Transportation. These rules do not authorize the placement of any new bench, only the addition of an outdoor advertising sign to an already existing bench structure.

(a) Bench signs are prohibited where the sign would be visible to:

(A) An interstate highway;

(B) A full control access highway;

(C) Any state highway where the area adjacent to the highway is a designated scenic area under ORS 377.505 to 377.540; or

(D) Any state highway designated as a scenic byway, unless the sign was legally in place before the byway designation.

(b) Size. The maximum allowable size for a bench sign is 16 square feet and the sign shall not exceed two feet in height or eight feet in length excluding supports.

(c) Height. The maximum allowable height is four feet including supports.

(d) Special Requirements:

(A) Bench signs may only be located in a commercial or industrial zone or, if located in unzoned city street right of way, only where such right of way is adjacent to a commercial or industrial zone;

(B) Bench signs may only be located inside incorporated city limits or within an urban growth boundary;

(C) Bench signs may only be located at a bus or transit stop on an official city or urban transit system route. The applicant must provide official documentation, such as a route map produced by the transit system, showing that the site meets this requirement;

(D) Bench signs shall not be located on state highway right of way.

(f) These rules do not apply to any bench sign for which a preexisting outdoor advertising sign permit has already been issued under ORS 377.725.

(2) All signs subject to these regulations are also subject to the provisions of ORS 377.700 to 377.840 and 377.992 and to all applicable federal laws, regulations and agreements entered into by the Transportation Commission and the Federal Highway Administration.

(3) All signs erected under these regulations are also subject to any city or county ordinance or regulation.

(4) All bench signs granted permits under these rules are subject to removal in accordance with ORS 377.775.

Stat. Auth.: ORS 184.616, 184.619, 377.753

Stats. Implemented: ORS 377.753

Hist.: 1 OTC 17-1979(Temp), f. & ef. 7-19-79; 1 OTC 26-1979, f. & ef. 10-30-79; HWY 5-1993(Temp), f. & cert. ef. 7-23-93; HWY 6-1993, f. & cert. ef. 10-21-93; HWD 1-2009, f. & cert. ef. 2-20-09; HWD 6-2012, f. & cert. ef. 3-26-12

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Portable Signs on Right of Way

734-060-0060

Portable Signs and Repeated Violations of ORS 377.650

Any sign as defined by ORS 377.710, which is portable in nature and which has been deposited, left or displayed on a state highway in violation of 377.650 may be removed and disposed of in the following manner:

(1) Five days after written notice of the violation of ORS 377.650 is mailed or 24 hours after notice is delivered in person to the person owning or controlling the portable sign, the District Manager (DM) or Assistant District Manager (Asst. DM) may have the sign removed and may charge the owner for the cost of removal and storage. The sign shall be stored for 30 days and if the sign is not claimed within 30 days, it may be sold, destroyed or otherwise disposed of.

(2) If the portable sign is determined by the DM or Asst. DM to create a traffic hazard, (e.g., signs on the paved portion of a highway or gravel shoulder, or signs placed upon state highway signs or appurtenances), the five day advance written notice need not be made but notice is to be made within 24 hours after removal.

(3) If the owner of the portable sign or person in control of the sign is not readily identified, by the sign itself or by contacting adjacent property owners, the sign may be removed immediately without notice. However, notice should be made upon subsequent identification of the sign owner.

Stat. Auth.: ORS 184 & ORS 377
Stats. Implemented: ORS 377.650
Hist.: 2HD 4-1985, f. & ef. 11-22-85

734-060-0065

Notice to a Portable Sign Owner

Notice to a portable sign owner shall include at least the following:

- (1) Statement that the sign is in violation of ORS 377.650.
- (2) The approximate location of the sign and a description of the sign.
- (3) Date the sign will be removed, or date on which the sign was removed.
- (4) Statement that the removal and storage costs are the responsibility of the owner.
- (5) Statement that sign shall be disposed of after 30 days of storage.
- (6) The cost of removal and storage.
- (7) A location of where the sign will be stored, or a person to contact concerning the storage.
- (8) A statement that the owner may remove the sign at the owner's expense prior to date of removal by the Department.
- (9) A statement that further violation will result in immediate removal without prior notification.

Stat. Auth.: ORS 184 & ORS 377
Stats. Implemented: ORS 377.650
Hist.: 2HD 4-1985, f. & ef. 11-22-85

734-060-0070

Previous Notice

If a previous notice has been given that a portable sign or other personal property violates ORS 377.650, and that sign, (a change of legend or message does not constitute a different sign), or property is again placed on a state highway, such items may be removed without further notice and stored for 30 days before further disposal. In such event notice shall be given subsequent to removal and the owner shall be given an opportunity for a hearing before the DM or Asst. DM to contest the violation and removal. The request for a hearing must be made within three working days after removal and the hearing must be held within five working days after such removal. The scope of this hearing shall be limited to whether proper prior notice was given, whether there was a subsequent violation and whether the sign or property was placed on a state highway. A written decision shall be made concerning the violation and removal procedure.

Stat. Auth.: ORS 184 & ORS 377
Stats. Implemented: ORS 377.650
Hist.: 2HD 4-1985, f. & ef. 11-22-85

734-060-0075

Removal Provisions

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Signs subject to OAR 734-027-0005 through 734-027-0050 are subject to the removal provisions of those rules and ORS 377.775.

Stat. Auth.: ORS 184 & ORS 377
 Stats. Implemented: ORS 377.650
 Hist.: 2HD 4-1985, f. & ef. 11-22-85

Exempt Sign Rules

734-060-0105

Signs of a Governmental Unit

(1) In order to qualify for a permit exemption under ORS 377.735(1)(a) as a sign of a governmental unit the following criteria must be satisfied:

- (a) The sign must be within the territorial or zoning jurisdiction of the governmental unit;
- (b) The governmental unit must have the authority to declare, expound, administer, or apply the law within the area;
- (c) The governmental unit may only erect the sign, or allow it to be erected, for the purpose of carrying out an official duty or responsibility directed or authorized by law.

(2) Location. Signs permitted by this rule are prohibited on state highway right of way.

(3) Size. Maximum area allowed is 200 square feet; maximum height or length allowed is 20 feet.

(4) Number. A governmental unit may have two such permit exemptions. If the limitation on number of signs will cause undue hardship, a waiver for additional signing may be granted by the Director, or authorized representative, upon application by the sign owner.

(5) The entire message must be contained on one sign. Fragmentation of messages on separate sign panels is prohibited.

(6) Signs erected under this rule are subject to the provisions of ORS 377.720 and to applicable federal requirements. Nothing in this rule is intended to permit a sign that is otherwise prohibited by a local government.

(7) No person may receive compensation for displaying the sign.

(8) This rule is not intended to regulate official traffic control signs or devices.

(9) To apply for the permit exemption an official of the governmental unit must submit a completed certification form, and an image of the proposed sign showing dimensions and copy, to the Outdoor Advertising Sign Program office.

Stat. Auth.: ORS 184.616, 184.619 & 377.735

Stats. Implemented: ORS 377.735

Hist.: HWY 1-1989, f. & cert. ef. 5-2-89; TO 7-2001, f. & cert. ef. 12-13-01; HWD 1-2009, f. & cert. ef. 2-20-09

734-060-0175

Temporary Signs

(1) This rule is enacted pursuant to ORS 377.735 regarding the permit exemption for temporary signs and in furtherance of the Oregon Motorist Information Act (OMIA, 377.700 through 377.840 and 377.992).

(2) Location generally. A temporary sign may be erected outside of state highway right of way, within view of a state highway, subject to the requirements of the local jurisdiction and the OMIA. A sign that complies with all the provisions of ORS 377.735(1)(b) may be erected without prior approval of the Department. A sign that requires a variance to comply must obtain that variance before erecting the sign. The Department may, at its discretion, retroactively grant a variance.

(3) The entire message must be contained on one sign. Fragmentation of messages on separate sign panels is prohibited.

(4) Changes in copy or location. For the sake of the time limits described in ORS 377.735(1)(b), the following will be considered one sign:

- (a) The same sign structure, regardless of copy, moved less than 600 feet from a former site; or
- (b) A different sign structure, regardless of copy, in approximately the same location as another sign that was removed.

(5) Variance Procedure.

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(a) A variance request must be in writing on a form provided by the Department. The request must be sent to the Outdoor Advertising Sign Program. There is no fee for a variance.

(b) A variance request must describe the specific location including:

(A) Name or number of highway;

(B) Side of highway; and

(C) Approximate milepoint, distance from a known highway feature (e.g. an intersection), or physical address.

(c) A variance request must describe the reason that constitutes good cause to grant the variance. If a reason is the amount of copy itself, requester must include the proposed copy. The Department may consider the amount, not the substance, of the copy.

(d) The request must include the name and mailing address of the requester. If the requester wants the Department to be able to make contact in any other way, such as to obtain supplemental information to process the request, requester may also include that contact information. The requester will be considered a sign owner for the sake of violation of sign laws.

(e) The request must include the date the sign will be posted and the date it will be removed so as to comply with the time limits to qualify for the exemption.

(f) Requester must certify that he or she:

(A) Has permission from the person in control of the property to post the sign;

(B) Will comply with all requirements of the local jurisdiction;

(C) Will not pay or receive any form of compensation for posting the sign; and

(D) Will comply with all requirements of the OMIA.

(g) The Department must grant or deny the request within 14 days after the Outdoor Advertising Sign Program receives it. The Department may deny applicant's variance request due to lack of required information; the applicant may re-submit the request. If the Department denies a request, fails to make a decision within 14 days, or grants and later revokes a variance, the requester may request a contested case hearing. Failure of the Department to meet the time limits required by this rule does not require that the variance be granted.

(h) If the Department determines a requester provided false information, including a false certification under (3)(f), it may deny the request and revoke any variance already granted to that person or the organization the applicant represents.

(i) Variances for both size and time will not be granted to the same sign or location. The Department will not grant more than 10 variances to one requester or organization for the same period of time.

(6) Specific Variance Criteria.

(a) Variance for size. The Department may grant a variance for size up to 32 square feet per side of a back-to-back sign. Good cause to grant a size variance may include, but is not limited to the following:

(A) Due to highway speed, width of right of way, topography, or other similar reasons beyond the applicant's control, the sign copy will not be legible to motorists if the sign is 12 square feet or less;

(B) Due to the amount of copy on the sign, the copy will not be legible to motorists if the sign is 12 square feet or less; or

(C) The sign was manufactured before the 12/13/2001 change in administrative rules regarding exempt signs, and the sign continues to comply with those former rules.

(b) Variance for time. The Department may grant a variance for time up to a total of 90 continuous days in a calendar year. The Department may grant the variance for good cause shown. Good cause may include, but is not limited to, a showing that:

(A) The applicant is attempting to obtain an outdoor advertising sign permit for the sign but will be unable to complete the application process within 60 days;

(B) Due to conditions of the land, weather, or similar reasons beyond requester's control, requester will be unable to remove the sign within 60 days.

(7) Prohibitions and penalties.

(a) Other than official traffic control devices, signs are prohibited in state highway right of way. Accessing a sign or sign site by crossing access-controlled right of way is prohibited. Violations of this rule are subject to ORS 377.725(9) and any other removal or penalty provision under law.

Signs in or overhanging state highway right of way may be removed pursuant to ORS 377.650 and OAR 734-060-0060 to 734-060-0070.

(b) Signs outside of right of way are subject to the removal procedures of ORS 377.775, and the penalty provisions of ORS 377.992 as well as any other penalty provision under law.

(c) If the sign or site has been accessed from access-controlled right of way, or the sign has been placed in or overhanging right of way, the Department may revoke any variance for that sign, by that requester, or by the represented organization. The Department may deny any subsequent variance request for that sign, by that requester, or by that organization at any location. If the Department discovers multiple violations of (a) above, it may file for an injunction under ORS 374.415.

(8) Signs erected under this rule are subject to the provisions of ORS 377.720 and to all applicable state and federal requirements.

Stat. Auth.: ORS 184.616, 184.619 & 377.735

Stats. Implemented: ORS 377.735

Hist.: HWY 1-1989, f. & cert. ef. 5-2-89; TO 7-2001, f. & cert. ef. 12-13-01; HWD 1-2009, f. & cert. ef. 2-20-09; HWD 11-2014, f. & cert. ef. 12-19-14

734-060-0185

Public Convenience and Safety Signs

(1) Location. Public convenience or safety signs are allowed on private property visible to a state highway, under the exemption in ORS 377.735, except as prohibited by these rules. Public convenience or safety signs are prohibited on state highway right of way unless approved in writing by the Deputy Director of the Department of Transportation. Public convenience signs must be within one mile of the convenience covered by the sign.

(2) Size. The maximum permissible size for public convenience or safety signs is six square feet.

(3) Spacing and Form. Minimum spacing between two public convenience or safety signs on the same side of the highway is 100 feet. The entire message must be contained on one sign. Fragmentation of messages on separate sign panels is prohibited.

(4) Qualification. Public safety signs are those necessary for the safety of the public such as, but not limited to, signs with legal notices or warnings, or signs warning of danger to the public. Public convenience signs are those necessary for guiding the public in the use of the state transportation system such as, but not limited to, signs identifying transit stops, freight entrances, train stations, ports, airports, or signs identifying public rest rooms.

(5) Signs erected under this rule are subject to ORS 377.720 and to applicable federal requirements.

(6) Removal. Signs erected under this rule are subject to the removal procedures as provided in ORS 377.775.

(7) No person or organization may receive compensation for the act of displaying a public convenience or safety sign.

(8) This rule is not intended to regulate, prohibit or limit official highway traffic control signs or devices.

Stat. Auth.: ORS 184.616, 184.619 & 377.735

Stats. Implemented: ORS 377.735

Hist.: TO 7-2001, f. & cert. ef. 12-13-01; HWD 1-2009, f. & cert. ef. 2-20-09

734-060-0190

Illuminated, Digital, or LED Signs Other than Outdoor Advertising Signs

(1) By statute, all signs visible to state highways are subject to state sign prohibited sign and safety regulations. No signs visible to a state highway, other than official traffic control signals or devices, may include moving or rotating parts or lights. Signs may not be made to resemble an official traffic signal or device and they may not have lights that project onto the roadway or impede the sight of traveling motorist.

(2) In interpreting ORS 377.715 and 377.720, signs visible to a state highway, other than official traffic control signals or devices, may not:

(a) Be illuminated by flashing lights or a light that varies in intensity;

(b) Have a display surface that creates the appearance of movement;

(c) May not operate at a brightness level of more than 0.3 foot-candles over ambient light, nor intensity greater than the luminance indicated in the table 1, as measured perpendicular to the face of the billboard at the indicated measurement distance for a designated sign dimension: [Table not included. See ED. NOTE.]

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(3) Newly constructed signs visible to a state highway, other than official traffic control signals or devices, must be:

(a) Equipped with a light sensor that automatically adjusts the intensity of the sign illumination according to the amount of ambient light, and;

(b) Designed to freeze the display in one static position, display a full black screen or turn off in the event of a malfunction.

[ED. NOTE: Tables referenced are not included in rule text. [Click here for PDF copy of table\(s\).](#)]

Stat. Auth.: ORS 184.616, 184.619, 377.710 & 377.720

Stats. Implemented: ORS 377.720

Hist.: HWD 11-2014, f. & cert. ef. 12-19-14

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OAAA Digital Technology Brief

Digital Billboards

Message Points

- Digital billboards serve businesses and communities by communicating information that can be quickly changed
- Digital billboards are accepted by government and the public
- Digital billboards are regulated by government and self-regulation by the industry
- Digital billboards are not distracting to drivers, according to government research
- Government relies of digital billboards on behalf of public safety
- Digital billboards support jobs



Government-sponsored anti-distraction message on digital billboard in Connecticut

Digital Billboards

High-tech communication for advertisers and communities

Digital technology is a non-manual way to change billboard “copy,” via computer. Digital billboards do not flash or scroll; they display static images that rotate typically every six or eight seconds.

Advertisers can change their messages quickly, without the time and expense of printing or posting. Other media are major buyers of digital billboards, featuring news, sports, weather, programming, and personalities.

Likewise, communities use digital billboards to deliver information to the public.



Other media are major buyers of digital billboards

Digital billboards are accepted/regulated

“Digital billboards are right in line with the whole cityscape. They communicate that we are a city that embraces technology. We actually have some of the newest state-of-the art cutting edge advertising,” said Joe Cimperman, a long-time city councilman in Cleveland, OH.

Keeping pace with technology, government has regulated and authorized digital billboards. The federal government says states can allow digital billboards as long as they do not flash, scroll, or feature full motion. Nearly all states with billboards allow digital billboards, which operate in nearly 1,000 communities.

Anti-billboard Scenic America attacked the federal guidelines in court; in 2014 a federal judge dismissed the case, with prejudice.

Industry practices conform to federal guidance, such as display times and lighting. Federal guidelines, issued in 2007, say digital billboards should “adjust brightness in response to changes in light levels so that the signs are not unreasonably bright for the safety of the motoring public.” Digital billboards are equipped with light sensors that adjust brightness to surrounding light conditions, to avoid glare.

The out of home advertising industry has established standards that lighting levels should not exceed 0.3 foot candles above the level of surrounding light conditions. State and local governments have incorporated this standard into regulations.

The OAAA *Code of Industry Principles* commits to providing effective and safe digital billboards:

- 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.

The respected media research firm Arbitron has studied public opinion (Los Angeles County, 2009, and the metro area of Cleveland, OH, 2008). With similar findings in each study, Arbitron says most commuters feel that digital billboards are a cool way to advertise and also provide important community information.

Traffic Safety

On December 30, 2013, the Federal Highway Administration (FHWA) released the findings of its multi-year research on drivers' behavior in proximity to digital billboards.

"DOT study finds digital billboards don't distract drivers," said the headline in *The Hill* newspaper in Washington, DC (January 7, 2014).

The government's findings tracked the outcome of industry-sponsored research, which found no connections to accidents.

FHWA's sister agency the National Highway Traffic Safety Administration (NHTSA) said in 2006: “Short, brief glances away from the forward roadway for the purpose of scanning the driving environment are safe and actually decrease near-crash/crash risk.”

This 2006 NHTSA study (“100-Car Naturalistic Driving Study”) said glances totaling more than 2 seconds increase crash risk. FHWA’s later research on digital billboards, released December 30, 2013, said the longest glances toward digital billboards were less than 1.3 seconds.

State review of crash data

Meanwhile, states have reviewed crash data. Effective January 1, 2015, New York State switched from 24-hour to 8-second display time on digital billboards. New York’s analysis of crash data “suggests there is no change in the crash patterns in the vicinity of the off-premise CEVMS billboards,” and continued monitoring is warranted.

Massachusetts DOT also looked at crash data: “The traffic engineers preparing the reports found no detrimental safety impacts” of the digital billboards.

A media report in 2015 summarized state regulatory acceptance of digital billboards, including New York State and Massachusetts.

Digital billboards help public safety



Emergency message after the Boston Marathon bombing

Government relies on digital billboards to communicate with the public.

Since 2008, the National Center for Missing & Exploited Children has transmitted more than 1,000 AMBER Alerts to digital billboards. The Center points out that time is of the essence after child abductions, and, therefore, quick posting on digital billboards is an important part of the AMBER Alert network.

The FBI says it has apprehended 53 fugitives as a direct result of tips from the public prompted by information on digital billboards.

The FBI calls digital billboards a "force multiplier." On March 16, 2012, FBI Director Robert S. Mueller presented the Director's Community Leadership Award to Ken Klein of the Outdoor Advertising Association of America in recognition of the industry's partnership to help law enforcement via digital billboards.



FBI Director Robert S. Mueller presents award to Ken Klein (OAAA)

At the local level, Albuquerque, NM, used digital billboards to urge conservation during a winter-time natural gas shortage. Police in Janesville, WI, post a variety of messages. "An elderly female suffering from Alzheimer's disease wandered away from family in a local shopping mall and was found by a citizen using the digital billboard information. When spring floods along the Rock River posed significant danger to the public, billboards were used to post warnings about the danger," wrote Chief of Police Neil Mahan (retired) in *The Police Chief* magazine.



FEMA message on digital billboard after storms hit Tuscaloosa, AL

Digital billboards support jobs

Billboard advertising supports jobs in local communities, typically more than two dozen jobs per advertiser. The digital sign industry also supports thousands of manufacturing jobs, incubates new ideas, and produces exports.

In 2001, Time-O-Matic, known for time-and-temperature signs, added Watchfire to its name to represent new products such as LED signs. "Watchfire is a living, thriving example for communities across America" that small business development is an engine of the overall economy, says Vicki Haugen of the economic development arm of Danville, IL, and surrounding Vermillion County.

U.S. Senator John Thune, R-SD, echoes that point. "Daktronics is the type of company that communities dream of having," said Thune, calling the company an "integral" part of the community of Brookings, SD. Daktronics designs and builds digital displays, electronic scoreboards, and programmable display systems. Each day in nearly 100 countries, millions of people depend on displays and scoring systems made by Daktronics, which is competing globally from small-town America.

In 1920, an immigrant from England named Tom Young went into the sign business with \$300. Today, Young Electric Sign Company – based in Salt Lake City, UT -- manufactures on-premise and off-premise signs including high-tech LED boards in Logan, UT.

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Guidance On Off-Premise Changeable Message Signs - Policy and Guidance - Outdoor Advertising Control - Real Estate - FHWA



Laws, Regs and Policy Guidance

Guidance On Off-Premise Changeable Message Signs

 U.S. Department of Transportation Federal Highway Administration	Memorandum		
Subject:	INFORMATION: Guidance On Off-Premise Changeable Message Signs	Date:	September 25, 2007
	ORIGINAL SIGNED BY: Gloria M. Shepherd		
From:	Gloria M. Shepherd Associate Administrator for Planning, Environment, and Realty	Reply to	HEPR-20
To:	Division Administrators ATTN: Division Realty Professionals		

Purpose

The purpose of this memorandum is to provide guidance to Division Realty Professionals concerning off-premises changeable message signs adjacent to routes subject to requirements for effective control under the Highway Beautification Act (HBA) codified at 23 U.S.C. 131. It clarifies the application of the Federal Highway Administration (FHWA) July 17, 1996, memorandum on this subject. This office may provide further guidance in the future as a result of additional information received through safety research, stakeholder input, and other sources.

Pursuant to 23 CFR 750.705, a State DOT is required to obtain the FHWA Division approval of any changes to its laws, regulations, and procedures to implement the requirements of its outdoor advertising control program. A State DOT should request and the Division offices should provide a determination as to whether the State should allow off-premises changeable Electronic Variable Message Signs (CEVMS) adjacent to controlled routes, as required by our delegation of responsibilities under 23 CFR 750.705(j). The Divisions that already have formally approved CEVMS use on HBA controlled routes, as well as, those that have not yet issued a decision, should re-evaluate their position in light of the following considerations. The decision of the Division should be based upon a review and approval of a State's affirmation and policy that: (1) is consistent with the existing Federal/State Agreement (FSA) for the particular State, and (2) includes but is not limited to consideration of requirements associated with the duration of message, transition time, brightness, spacing, and location, submitted for the FHWA approval, that evidence reasonable and safe standards to regulate such signs are in place for the protection of the motoring public. Proposed laws, regulations, and procedures that would allow permitting CEVMS subject to acceptable criteria (as described below) do not violate a prohibition against "intermittent" or "flashing" or "moving" lights as those terms are used in the various FSAs that have been entered into during the 1960s and 1970s.

This guidance is applicable to conforming signs, as applying updated technology to nonconforming signs would be considered a substantial change and inconsistent with the requirements of 23 CFR 750.707(d) (5). As noted below, all of the requirements in the HBA and its implementing regulations, and the specific provisions of the FSAs, continue to apply.

Background

The HBA requires States to maintain effective control of outdoor advertising adjacent to certain controlled routes. The reasonable, orderly and effective display of outdoor advertising is permitted in zoned or unzoned commercial or industrial areas. Signs displays and devices whose size, lighting and spacing are consistent with customary use determined by agreement between the several States and the Secretary, may be erected and maintained in these areas (23 U.S.C. § 131(d)). Most of these agreements between the States and the Secretary that determined the size, lighting and spacing of conforming signs were signed in the late 1960's and the early 1970's.

On July 17, 1996, the Office of Real Estate Services issued a memorandum to Regional Administrators to provide guidance on off-premise changeable message signs and confirmed that the FHWA has "always applied the Federal law 23 U.S.C. 131 as it is interpreted and implemented under the Federal regulations and individual FSAs." It was expressly noted that "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 the FHWA to interpret the agreements with those changes in mind." The July 17, 1996, memorandum primarily addressed tri-vision signs, which were the leading technology at the time, but it specifically noted that changeable message signs "regardless of the type of technology used" are permitted if the interpretation of the FSA allowed them. Further advances in technology and affordability of LED and other complex electronic message signs, unanticipated at the time the FSAs were entered into, require the FHWA to confirm and expand on the principles set forth in the July 17, 1996, memorandum.

The policy espoused in the July 17, 1996, memorandum was premised upon the concept that changeable messages that were fixed for a reasonable time period do not constitute a moving sign. If the State set a reasonable time period, the agreed-upon prohibition against moving signs is not violated. Electronic signs that have stationary messages for a reasonably fixed time merit the same considerations.

Discussion

Changeable message signs, including Digital/LED Display CEVMS, are acceptable for conforming off-premise signs, if found to be consistent with the FSA and with acceptable and approved State regulations, policies and procedures.

This guidance does not prohibit States from adopting more restrictive requirements for permitting CEVMS to the extent those requirements are not inconsistent with the HBA, Federal regulations, and existing FSAs. Similarly, Divisions are not required to concur with State proposed regulations, policies, and procedures if the Division review determines, based upon all relevant information, that the proposed regulations, policies and procedures are not consistent with the FSA or do not include adequate standards to address the safety of the motoring public. If the Division Office has any question that the FSA is being fully complied with, this should be discussed with the State and a process to change the FSA may be considered and completed before such CEVMS may be allowed on HBA controlled routes. The Office of Real Estate Services is available to discuss this process with the Division, if requested.

If the Division accepts the State's assertions that their FSA permits CEVMS, in reviewing State-proposed regulations, policy and procedures for acceptability, the Divisions should consider all relevant information, including, but not limited to duration of message, transition time, brightness, spacing, and location, to ensure that they are consistent with their FSA and that there are adequate standards to address safety for the motoring public. The Divisions should also confirm that the State provided for appropriate public input, consistent with applicable State law and requirements, in its interpretation of the terms of their FSA as allowing CEVMS in accordance with their proposed regulations, policies, and procedures.

Based upon contacts with all Divisions, we have identified certain ranges of acceptability that have been adopted in those States that do allow CEVMS that will be useful in reviewing State proposals on this topic. Available information indicates that State regulations, policy and procedures that have been approved by the Divisions to date, contain some or all of the following standards:

- Duration of Message
 - Duration of each display is generally between 4 and 10 seconds - 8 seconds is recommended.
- Transition Time
 - Transition between messages is generally between 1 and 4 seconds - 1-2 seconds is recommended.
- Brightness

- Adjust brightness in response to changes in light levels so that the signs are not unreasonably bright for the safety of the motoring public.
- Spacing
 - Spacing between such signs not less than minimum spacing requirements for signs under the FSA, or greater if determined appropriate to ensure the safety of the motoring public.
- Locations
 - Locations where allowed for signs under the FSA except such locations where determined inappropriate to ensure safety of the motoring public.

Other standards that the States have found helpful to ensure driver safety include a default designed to freeze a display in one still position if a malfunction occurs; a process for modifying displays and lighting levels where directed by the State DOT to assure safety of the motoring public; and requirements that a display contain static messages without movement such as animation, flashing, scrolling, intermittent or full-motion video.

Conclusion

This guidance is intended to provide information to assist the Divisions in evaluating proposals and to achieve national consistency given the variations in FSAs, State law, and State regulations, policies and procedures. It is not intended to amend applicable legal requirements. Divisions are strongly encouraged to work with their State in its review of their existing FSAs and, if appropriate, assist in pursuing amendments to address proposed changes relating to CEVMS or other matters. In this regard, the Office of Realty Estate Services is currently reviewing the process for amending FSAs, as established in 1980, to determine appropriate revisions to streamline requirements while continuing to ensure there is adequate opportunity for public involvement.

For further information on guidance on Off-Premise Changeable Message Signs, you may contact the Office of Real Estate Services' "Point of Contact" serving your Division or the contact on this page.

836 F.3d 42

United States Court of Appeals,
District of Columbia Circuit.

Scenic America, Inc., Appellant,

v.

United States Department of
Transportation, et al., Appellees.

No. 14-5195

|

Argued September 25, 2015

|

Decided September 6, 2016

Synopsis

Background: Non-profit organization brought action pursuant to Administrative Procedure Act (APA) against Department of Transportation and its Secretary, as well as Federal Highway Administration (FHWA) and its Administrator, challenging guidance memorandum issued by FHWA, which interpreted Highway Beautification Act's (HBA) prohibition on "flashing, intermittent or moving" lights on billboards to permit state approval of those digital billboards that met certain timing and brightness requirements. After defendants' motion to dismiss for lack of standing was denied, 983 F.Supp.2d 170, the United States District Court for the District of Columbia, James E. Boasberg, J., 49 F.Supp.3d 53, granted defendants' motion for summary judgment. Organization appealed.

Holdings: The Court of Appeals, Wilkins, Circuit Judge, held that:

[1] organization's alleged organizational injury was not redressable through vacatur of guidance memorandum;

[2] organization presented sufficient evidence that it had suffered representational injury-in-fact;

[3] organization's representational injury was redressable through repudiation of FHWA's interpretation;

[4] guidance memorandum was final agency action; and

[5] guidance memorandum was not promulgated contrary to law.

Affirmed in part; vacated and remanded in part.

West Headnotes (19)

[1] Federal Courts

🔑 Limited jurisdiction;jurisdiction as dependent on constitution or statutes

170B Federal Courts

170BII Jurisdiction, Powers, and Authority in General

170BII(A) In General

170Bk2012 Judicial Power of United States; Power of Congress

170Bk2015 Limited jurisdiction;jurisdiction as dependent on constitution or statutes

Federal courts are not courts of general jurisdiction; they have only the power that is authorized by Article III of the Constitution and the statutes enacted by Congress pursuant thereto. U.S. Const. art. 3.

Cases that cite this headnote

[2] Constitutional Law

🔑 Separation of Powers

Constitutional Law

🔑 Nature and scope in general

Federal Civil Procedure

🔑 In general;injury or interest

92 Constitutional Law

92XX Separation of Powers

92XX(A) In General

92k2330 In general

92 Constitutional Law

92XX Separation of Powers

92XX(C) Judicial Powers and Functions

92XX(C)1 In General

92k2450 Nature and scope in general

170A Federal Civil Procedure

170AII Parties

170AII(A) In General

170Ak103.1 Standing in General

170Ak103.2 In general;injury or interest

The standing requirements of Article III are grounded in respect for the separation of powers tenets that are the foundation of the nation's system of government, and they help prevent the judicial process from being used to usurp the powers of the political branches. U.S. Const. art. 3.

[Cases that cite this headnote](#)

[3] Federal Courts

🔑 [Determination of question of jurisdiction](#)

[170B](#) Federal Courts

[170BXVII](#) Courts of Appeals

[170BXVII\(B\)](#) Appellate Jurisdiction and Procedure in General

[170Bk3252](#) Determination of question of jurisdiction

Observing the federal court's Article III limitations is always important, and particularly so in a case where the Court of Appeals is asked to invalidate an action of the Executive branch. U.S. Const. art. 3.

[1](#) [Cases that cite this headnote](#)

[4] Federal Civil Procedure

🔑 [In general;injury or interest](#)

Federal Civil Procedure

🔑 [Causation;redressability](#)

[170A](#) Federal Civil Procedure

[170AII](#) Parties

[170AII\(A\)](#) In General

[170Ak103.1](#) Standing in General

[170Ak103.2](#) In general;injury or interest

[170A](#) Federal Civil Procedure

[170AII](#) Parties

[170AII\(A\)](#) In General

[170Ak103.1](#) Standing in General

[170Ak103.3](#) Causation;redressability

The irreducible constitutional minimum of standing requires that a plaintiff demonstrate three elements: (1) injury in fact; (2) causation; and (3) redressability. U.S. Const. art. 3.

[1](#) [Cases that cite this headnote](#)

[5] Federal Civil Procedure

🔑 [In general;injury or interest](#)

[170A](#) Federal Civil Procedure

[170AII](#) Parties

[170AII\(A\)](#) In General

[170Ak103.1](#) Standing in General

[170Ak103.2](#) In general;injury or interest

The party invoking federal jurisdiction bears the burden of establishing the elements of Article III standing; each element must be supported in the same way as any other matter on which the plaintiff bears the burden of proof, i.e., with the manner and degree of evidence required at the successive stages of the litigation. U.S. Const. art. 3.

[Cases that cite this headnote](#)

[6] Federal Civil Procedure

🔑 [Pleading](#)

[170A](#) Federal Civil Procedure

[170AII](#) Parties

[170AII\(A\)](#) In General

[170Ak103.1](#) Standing in General

[170Ak103.5](#) Pleading

At the pleading stage, general factual allegations of injury resulting from the defendant's conduct may suffice to establish Article III standing. U.S. Const. art. 3.

[Cases that cite this headnote](#)

[7] Federal Civil Procedure

🔑 [In general;injury or interest](#)

[170A](#) Federal Civil Procedure

[170AII](#) Parties

[170AII\(A\)](#) In General

[170Ak103.1](#) Standing in General

[170Ak103.2](#) In general;injury or interest

A court's determination that a plaintiff has established Article III standing at the motion to dismiss stage by alleging sufficient facts in her pleadings is only the first step, because that finding does not obviate the court's responsibility to ensure that the plaintiff can actually prove those allegations when one or both parties seek summary judgment. U.S. Const. art. 3.

[Cases that cite this headnote](#)

[8] Federal Civil Procedure [In general;injury or interest](#)[170A](#) Federal Civil Procedure[170AII](#) Parties[170AII\(A\)](#) In General[170Ak103.1](#) Standing in General[170Ak103.2](#) In general;injury or interest

Even where the court denies a motion to dismiss based on lack of Article III standing, in response to a summary judgment motion, the plaintiff can no longer rest on mere allegations, but must set forth by affidavit or other evidence specific facts establishing standing; if, upon review of the evidence, the court determines that the plaintiff has not introduced sufficient evidence into the record to at least raise a disputed issue of fact as to each element of standing, the court has no power to proceed and must dismiss the case. U.S. Const. art. 3.

[3 Cases that cite this headnote](#)**[9] Federal Courts** [Determination of question of jurisdiction](#)[170B](#) Federal Courts[170BXVII](#) Courts of Appeals[170BXVII\(B\)](#) Appellate Jurisdiction and Procedure in General[170Bk3252](#) Determination of question of jurisdiction

Every federal appellate court has a special obligation to satisfy itself not only of its own jurisdiction, but also that of the lower courts in a cause under review.

[Cases that cite this headnote](#)**[10] Federal Courts** [Determination of question of jurisdiction](#)[170B](#) Federal Courts[170BXVII](#) Courts of Appeals[170BXVII\(B\)](#) Appellate Jurisdiction and Procedure in General[170Bk3252](#) Determination of question of jurisdiction

If the Court of Appeals determines that the district court was without jurisdiction, then the Court of Appeals has jurisdiction on

appeal, not of the merits but merely for the purpose of correcting the error of the lower court in entertaining the suit.

[Cases that cite this headnote](#)**[11] Federal Courts** [Standing](#)[170B](#) Federal Courts[170BXVII](#) Courts of Appeals[170BXVII\(K\)](#) Scope and Extent of Review[170BXVII\(K\)2](#) Standard of Review[170Bk3576](#) Procedural Matters[170Bk3585](#) Parties[170Bk3585\(2\)](#) Standing

The Court of Appeals reviews a district court's decision as to Article III standing de novo. U.S. Const. art. 3.

[Cases that cite this headnote](#)**[12] Federal Civil Procedure** [In general;injury or interest](#)[170A](#) Federal Civil Procedure[170AII](#) Parties[170AII\(A\)](#) In General[170Ak103.1](#) Standing in General[170Ak103.2](#) In general;injury or interest

When the existence of one or more of the essential elements of Article III standing depends on the unfettered choices made by independent actors not before the courts and whose exercise of broad and legitimate discretion the courts cannot presume either to control or to predict, it becomes substantially more difficult to establish standing. U.S. Const. art. 3.

[1 Cases that cite this headnote](#)**[13] Federal Civil Procedure** [Causation;redressability](#)[170A](#) Federal Civil Procedure[170AII](#) Parties[170AII\(A\)](#) In General[170Ak103.1](#) Standing in General[170Ak103.3](#) Causation;redressability

Mere unadorned speculation as to the existence of a relationship between the

challenged government action and the third-party conduct will not suffice to invoke the federal judicial power under the redressability element of Article III standing. U.S. Const. art. 3.

[Cases that cite this headnote](#)

[14] Associations

🔑 [Actions by or Against Associations](#)

41 Associations

41k20 Actions by or Against Associations

41k20(1) In general

Non-profit organization lacked Article III standing to challenge, through Administrative Procedure Act (APA) notice-and-comment claim, Federal Highway Administration (FHWA) guidance memorandum which interpreted Highway Beautification Act's (HBA) prohibition on "flashing, intermittent or moving" lights on billboards to permit state approval of digital billboards that met certain timing and brightness requirements; organization's alleged injury, that it was forced to expend greater resources opposing digital billboards, was not redressable through vacatur of the memorandum, since state officials could find such billboards permissible for reasons other than those stated in the memorandum. U.S. Const. art. 3.; [5 U.S.C.A. § 551 et seq.](#); [23 U.S.C.A. § 131](#).

[Cases that cite this headnote](#)

[15] Associations

🔑 [Actions by or Against Associations](#)

41 Associations

41k20 Actions by or Against Associations

41k20(1) In general

Non-profit organization presented sufficient evidence that it had suffered representational injury-in-fact, stemming from Federal Highway Administration's (FHWA) promulgation of guidance memorandum that interpreted Highway Beautification Act's (HBA) prohibition on "flashing, intermittent or moving" lights on billboards to permit state approval of those digital billboards that met certain timing

and brightness requirements, as required for organization to have Article III standing to bring an arbitrary and capricious challenge to the memorandum; one of organization's members alleged that digital billboard near her home generated bright flash, and that billboard marred view from her home and negatively affected value of her property. U.S. Const. art. 3.; [5 U.S.C.A. § 551 et seq.](#); [23 U.S.C.A. § 131](#).

[Cases that cite this headnote](#)

[16] Associations

🔑 [Actions by or Against Associations](#)

41 Associations

41k20 Actions by or Against Associations

41k20(1) In general

Alleged representational injury of non-profit organization stemming from Federal Highway Administration's (FHWA) promulgation of guidance memorandum that interpreted Highway Beautification Act's (HBA) prohibition on "flashing, intermittent or moving" lights on billboards to permit state approval of digital billboards that met certain timing and brightness requirements, was redressable through judicial repudiation of FHWA's interpretation, as required for organization to have Article III standing to bring an arbitrary and capricious challenged to the memorandum; repudiation would prohibit FHWA from relying on that interpretation in future rulemaking and require FHWA to subject extant billboards to either removal or an order requiring their operation consistent with flashing light restrictions. U.S. Const. art. 3.; [5 U.S.C.A. § 551 et seq.](#); [23 U.S.C.A. § 131](#).

[Cases that cite this headnote](#)

[17] Administrative Law and Procedure

🔑 [Finality;ripeness](#)

15A Administrative Law and Procedure

15AV Judicial Review of Administrative Decisions

15AV(B) Decisions and Acts Reviewable

15Ak704 Finality;ripeness

An agency action will be deemed final, and therefore reviewable under the Administrative Procedure Act (APA), if it marks the consummation of the agency's decisionmaking process and is an action by which rights or obligations have been determined, or from which legal consequences will flow; the most important factor in determining whether an agency action is one from which legal consequences will flow concerns the actual legal effect, or lack thereof, of the agency action in question on regulated entities. [5 U.S.C.A. § 551 et seq.](#)

[Cases that cite this headnote](#)

[18] **Highways**

 [Billboards and highway beautification in general](#)

[200 Highways](#)

[200IX Regulation and Use for Travel](#)

[200IX\(A\) Obstructions and Encroachments](#)

[200k153.5 Billboards and highway beautification in general](#)

Federal Highway Administration's (FHWA) promulgation of guidance memorandum, which interpreted Highway Beautification Act's (HBA) prohibition on “flashing, intermittent or moving” lights on billboards to permit state approval of those digital billboards that met certain timing and brightness requirements, was final agency action that was subject to review under Administrative Procedure Act (APA); memorandum came to definitive conclusion in interpreting HBA, and memorandum withdrew some of the discretion concerning billboard permitting that states previously held. [5 U.S.C.A. § 551 et seq.](#); [23 U.S.C.A. § 131](#).

[Cases that cite this headnote](#)

[19] **Highways**

 [Billboards and highway beautification in general](#)

[200 Highways](#)

[200IX Regulation and Use for Travel](#)

[200IX\(A\) Obstructions and Encroachments](#)

[200k153.5 Billboards and highway beautification in general](#)

Federal Highway Administration's (FHWA) guidance memorandum, which interpreted Highway Beautification Act's (HBA) prohibition on “flashing, intermittent or moving” lights on billboards to permit state approval of digital billboards that met certain timing and brightness requirements, was not promulgated contrary to law in violation of the Administrative Procedure Act (APA); HBA required lighting standards in federal-state agreements to be “consistent with customary use,” and guidance memorandum did not change lighting standards to such extent that those standards were no longer consistent with customary use. [5 U.S.C.A. § 551 et seq.](#); [23 U.S.C.A. § 131](#).

[Cases that cite this headnote](#)

***45** Appeal from the United States District Court for the District of Columbia, (No. 1:13-cv-00093)

Attorneys and Law Firms

[Daniel H. Lutz](#), Orrville, OH, argued the cause for appellant. With him on the briefs was [Hope M. Babcock](#). Thomas M. Gremillion entered an appearance.

[William D. Brinton](#), Jacksonville, FL, was on the brief for amici curiae The American Planning Association, et al. in support of petitioner.

[Jeffrey E. Sandberg](#), Attorney, U.S. Department of Justice, argued the cause for federal appellees. With him on the brief were [Ronald C. Machen Jr.](#), U.S. Attorney at the time the brief was filed, and [Mark R. Freeman](#), Attorney.

[Kannon K. Shanmugam](#) argued the cause for intervenor-appellee Outdoor Advertising Association of America, Inc. With him on the brief was [Allison B. Jones](#), Washington, DC.

Before: Pillard and Wilkins, Circuit Judges, and Ginsburg, Senior Circuit Judge.

Opinion

Wilkins, Circuit Judge:

The Highway Beautification Act (“HBA”), 23 U.S.C. § 131, requires the Federal Highway Administration (“FHWA”) and each state to develop and implement individual federal-state agreements (“FSAs”), detailing, among other things, “size, lighting and spacing” standards for the billboards now found towering over many of our country's interstate highways. One of those adopted standards, included in most states' FSAs, prohibits those states from erecting any billboard with “flashing, intermittent or moving” lights (the “FSA lighting standards”).

Plaintiff-Appellant Scenic America is a non-profit organization which “seeks to preserve and improve the visual character of America's communities and countryside.” Compl. ¶ 7, J.A. 10. It challenges a guidance memorandum issued by the FHWA in 2007, which interpreted that prohibition on “flashing, intermittent or moving” lights to permit state approval of those digital billboards that met certain timing and brightness requirements. Scenic argues that the guidance memorandum must be invalidated because it (1) was not promulgated using notice-and-comment procedures, and (2) violates the HBA, and was therefore promulgated “contrary to law” in violation of § 706 of the Administrative Procedure Act (“APA”), 5 U.S.C. §§ 551 *et seq.*

We hold that we lack jurisdiction to hear Scenic's notice-and-comment claim because Scenic has failed to demonstrate that it has standing to bring that challenge, and deny its § 706 claim on the merits.

I.

A.

In 1965, Congress enacted the Highway Beautification Act to control “the erection and maintenance of outdoor advertising signs, displays, and devices in areas adjacent to the Interstate System ... in order to protect the public investment in such highways, to promote the safety and recreational value of public travel, and to preserve

natural beauty.” 23 U.S.C. § 131(a). The HBA penalizes those states that fail to maintain “effective control” over their advertising signs by permitting the Secretary of Transportation to reduce their federal highway funds by ten percent. *Id.* § 131(b).

To maintain effective control, each state is required to, among other things, negotiate *46 an FSA with the Secretary that establishes standards for the “size, lighting and spacing” of billboards that come within 660 feet of the Interstate. *Id.* § 131(d). The HBA requires that those standards be “consistent with customary use.” *Id.* All fifty states entered into such FSAs, most of which were written in the 1960s and 1970s. *See Scenic Am., Inc. v. U.S. Dep't of Transp. (Scenic II)*, 49 F.Supp.3d 53, 57 (D.D.C. 2014). FHWA regulations, promulgated under the HBA, require that states “[d]evelop laws, regulations, and procedures” that implement the standards contained in each state's FSA. 23 C.F.R. § 750.705(h). States must submit these laws, regulations, and procedures to the FHWA's regional offices, known as Division Offices, for approval. *Id.* § 750.705(j). The FHWA has one Division Office located in each state.

Although each of the FSAs was individually negotiated, most contain similar terms. Nearly all of the FSAs contain a prohibition against “flashing,” “intermittent,” and “moving” lights. *See, e.g.*, J.A. 120 (New York FSA); J.A. 131 (Colorado FSA); J.A. 139 (North Carolina FSA).

As billboard technology changed, states began considering or passing laws that permitted digital billboards to be displayed along the Interstate. *See, e.g.*, J.A. 422-23 (letter from Indiana Department of Transportation to Indiana FHWA Division Office informing the Division Office that Indiana had passed a law permitting certain digital billboards); J.A. 424 (letter from the Indiana FHWA Division Office to the Indiana Department of Transportation acknowledging the letter and agreeing that the digital billboards discussed in Indiana's previous letter “do[] not constitute flashing, intermittent or moving lights”); J.A. 437 (letter from Arkansas Highway Commission to Arkansas FHWA Division Office noting new regulations permitting digital billboards); J.A. 183 (United States Department of Transportation memorandum discussing digital billboard in Nebraska). These billboards, sometimes referred to as “commercial electronic variable message signs” (“CEVMS”), typically use LED lights to display

a static advertisement that remains on the screen for a specified period of time before quickly transitioning to a different static advertisement. Advertisements typically remain visible for around ten seconds, and usually take approximately two seconds to transition to the next ad.

The FHWA's Division Offices differed on whether digital billboards complied with the FSA lighting standards. *Compare, e.g.*, J.A. 424 (Indiana Division Office agreeing that digital billboards “do[] not constitute flashing, intermittent or moving lights”), *with, e.g.*, J.A. 263 (Texas Division Office stating that “[w]hile the technology for LED displays did not exist at the time of the [FSA], the wording in the [FSA] clearly prohibits such signs”). In 2007, the national FHWA office weighed in. It issued to its Division Offices a memorandum entitled “Guidance on Off-Premise Changeable Message Signs” (the “Guidance” or “2007 Guidance”), a portion of which stated as follows:

Proposed laws, regulations, and procedures that would allow permitting CEVMS subject to acceptable criteria (as described below) do not violate a prohibition against “intermittent” or “flashing” or “moving” lights as those terms are used in the various FSAs that have been entered into during the 1960s and 1970s.

J.A. 535. The FHWA went on to identify those “acceptable criteria” based on “certain ranges of acceptability that have been adopted in those States that do allow CEVMS.” J.A. 534, 537 (recommending, among other things, that each display generally remain static for between four and *47 ten seconds, and transition to a new display in one to four seconds).

According to a survey the FHWA distributed to states shortly before issuing the 2007 Guidance, many states with FSAs that included a ban on intermittent, flashing, or moving lights permitted digital billboards before the FHWA issued the Guidance. J.A. 531-32. The Division Office for at least two states, Texas and Kentucky, did not permit digital billboards prior to the 2007 Guidance. *See Scenic Am., Inc. v. U.S. Dep't of Transp. (Scenic I)*, 983 F.Supp.2d 170, 179–80 (D.D.C. 2013). After the Guidance, Texas began to permit the use of digital billboards. Lloyd Decl. ¶ 9, J.A. 41.

B.

Scenic brought this suit against the United States Department of Transportation, the federal executive department responsible for implementation of the HBA; the FHWA, which promulgated the 2007 Guidance; Ray LaHood, the Secretary of Transportation at the time; and Victor Mendez, the Administrator of FHWA at the time. Scenic did not include any of the FHWA's Division Offices in this suit. Outdoor Advertising Association of America, Inc. (“OAAA”) intervened as a defendant shortly after Scenic brought suit.

Scenic's suit alleges two claims relevant to this appeal: (1) the 2007 Guidance constitutes a legislative, not interpretive rule, thus violating § 553 of the APA, because it was not promulgated using notice-and-comment procedures; and (2) the Guidance violates § 706 of the APA because it creates a new lighting standard that is not “consistent with customary use,” as required by the HBA.¹ Compl. ¶¶ 48-53, 57-62, J.A. 17-19.

¹ Scenic abandoned a third claim on appeal—that the Guidance improperly creates new lighting standards, in contravention of the procedures for creating new standards set forth in the HBA. *See* Br. for Defendants-Appellees [hereinafter “FHWA Br.”], *Scenic Am., Inc. v. U.S. Dep't of Transp.*, No. 14–5195 (D.C. Cir. Feb. 20, 2015), Doc. No. 1538780, at 16 & n.7.

The FHWA and the OAAA (collectively “Defendants”) moved to dismiss, contending that Scenic lacked standing, and that the court lacked jurisdiction over the Guidance because it did not constitute final agency action under the APA. *Scenic I*, 983 F.Supp.2d at 172–73. The District Court denied Defendants' motion as to both claims. *Id.*

Relevant to our decision here, the District Court held, at the motion to dismiss stage, that Scenic's requested relief would redress its harm because “vacating the Guidance would return the FHWA to agnosticism on the question [of permitting digital billboards], leaving Division Offices free to draw their own conclusions.” *Id.* at 181. According to the District Court, this would prevent Scenic from “hav[ing] to police as intensively new digital-billboard construction around the country.” *Id.*

Defendants later moved for summary judgment, and the District Court granted the motions, finding that the Guidance was not subject to notice-and-comment requirements because it was an interpretive, not legislative rule, and that it did not violate the “consistent with customary use” provision of the HBA. *Scenic II*, 49 F.Supp.3d at 59–71. Defendants, in their summary judgment briefing below, did not again challenge Scenic's standing, and the District Court did not discuss Scenic's standing in its written Opinion granting Defendants' summary judgment motions.

II.

We begin, as we must, by addressing our jurisdiction to review Scenic's appeal. Because Scenic must demonstrate its *48 standing separately as to each of the two claims it brings on appeal, *see Catholic Soc. Serv. v. Shalala*, 12 F.3d 1123, 1125 (D.C. Cir. 1994), we find that, although Scenic has standing to bring its claim concerning FHWA's alleged § 706 violation, Scenic has failed to demonstrate it has standing to bring its notice-and-comment claim.

A.

[1] [2] [3] As has been expressed time and time again, “[f]ederal courts are not courts of general jurisdiction; they have only the power that is authorized by Article III of the Constitution and the statutes enacted by Congress pursuant thereto.” *Bender v. Williamsport Area Sch. Dist.*, 475 U.S. 534, 541, 106 S.Ct. 1326, 89 L.Ed.2d 501 (1986). As Chief Justice Marshall observed, “[i]f the judicial power extended to every question under the constitution it would involve almost every subject proper for legislative discussion and decision [and] if to every question under the laws and treaties of the United States it would involve almost every subject on which the executive could act.” *DaimlerChrysler Corp. v. Cuno*, 547 U.S. 332, 341, 126 S.Ct. 1854, 164 L.Ed.2d 589 (2006) (quoting 4 PAPERS OF JOHN MARSHALL 95 (C. Cullen ed. 1984)) (emphases omitted). Thus, without studious adherence to the metes and bounds of our jurisdiction as imposed by Article III, Chief Justice Marshall warned that “the other departments [of the government] would be swallowed up by the judiciary.” *Id.* The standing requirements of Article III are therefore grounded in respect for the separation of powers tenets that are the

foundation of our system of government, *Valley Forge Christian Coll. v. Ams. United for Separation of Church & State, Inc.*, 454 U.S. 464, 471–74, 102 S.Ct. 752, 70 L.Ed.2d 700 (1982), and they help “prevent the judicial process from being used to usurp the powers of the political branches,” *Clapper v. Amnesty Int'l USA*, — U.S. —, 133 S.Ct. 1138, 1146, 185 L.Ed.2d 264 (2013). Observing our Article III limitations is therefore always important, and particularly so in a case such as this, where we are asked to invalidate an action of the Executive branch.

[4] [5] The “irreducible constitutional minimum of standing” requires that a plaintiff demonstrate three elements: (1) injury in fact; (2) causation; and (3) redressability. *Lujan v. Defs. of Wildlife*, 504 U.S. 555, 560–61, 112 S.Ct. 2130, 119 L.Ed.2d 351 (1992). “The party invoking federal jurisdiction bears the burden of establishing these elements”; “each element must be supported in the same way as any other matter on which the plaintiff bears the burden of proof, *i.e.*, with the manner and degree of evidence required at the successive stages of the litigation.” *Id.* at 561, 112 S.Ct. 2130.

[6] [7] [8] Thus, the plaintiff must meet this burden at the outset of *each* phase. “At the pleading stage, general factual allegations of injury resulting from the defendant's conduct may suffice....” *Id.* And a court's determination that a plaintiff has established standing at the motion to dismiss stage by *alleging* sufficient facts in her pleadings is only the first step, because that finding does not obviate the court's responsibility to ensure that the plaintiff can actually *prove* those allegations when one or both parties seek summary judgment. So even where the court denies a motion to dismiss based on lack of standing, “[i]n response to a summary judgment motion, ... the plaintiff can no longer rest on such mere allegations, but must set forth by affidavit or other evidence specific facts [establishing standing].” *Id.* (internal quotation marks omitted).² If, upon review *49 of the evidence, the court determines that the plaintiff has not introduced sufficient evidence into the record to at least raise a disputed issue of fact as to each element of standing, the court has no power to proceed and must dismiss the case. *See, e.g., Clapper*, 133 S.Ct. at 1148–49 (dismissing case where plaintiff did not raise an issue of fact as to standing at summary judgment).

² Our treatment of standing in cases that come to us directly on administrative review is instructive. Because these petitions for administrative review

bypass the district court and come to us directly, we treat them as a district court would in deciding a motion for summary judgment. See *Sierra Club v. EPA*, 292 F.3d 895, 899 (D.C. Cir. 2002). In *Sierra Club*, we held, “mindful of our independent obligation to be sure of our jurisdiction,” that the petitioner there had failed to establish its burden as to standing. *Id.* at 898, 902. We explained that “[t]he petitioner’s burden of production in the court of appeals is ... the same as that of a plaintiff moving for summary judgment in the district court: it must support each element of its claim to standing ‘by affidavit or other evidence.’” *Id.* at 899 (quoting *Defs. of Wildlife*, 504 U.S. at 561, 112 S.Ct. 2130).

Just as we must ensure our jurisdiction over petitions brought to us directly, so too must the district court assure itself of its jurisdiction before assessing a summary judgment motion on the merits.

[9] [10] In addition, “every federal appellate court has a special obligation to ‘satisfy itself not only of its own jurisdiction, but also that of the lower courts in a cause under review.’” *Bender*, 475 U.S. at 541, 106 S.Ct. 1326 (quoting *Mitchell v. Maurer*, 293 U.S. 237, 244, 55 S.Ct. 162, 79 L.Ed. 338 (1934)). If we determine that the District Court was without jurisdiction, then “we have jurisdiction on appeal, not of the merits but merely for the purpose of correcting the error of the lower court in entertaining the suit.” *Steel Co. v. Citizens for a Better Env’t*, 523 U.S. 83, 95, 118 S.Ct. 1003, 140 L.Ed.2d 210 (1998) (quoting *Arizonans for Official English v. Arizona*, 520 U.S. 43, 73, 117 S.Ct. 1055, 137 L.Ed.2d 170 (1997)).

[11] We review the District Court’s decision (or lack thereof) as to standing *de novo*, *Info. Handling Servs., Inc. v. Def. Automated Printing Servs.*, 338 F.3d 1024, 1029 (D.C. Cir. 2003), and hold that Scenic has not met its burden of establishing its standing to bring its notice-and-comment claim.³

³ The FHWA challenged Scenic America’s standing at the motion to dismiss stage, and though the District Court held in favor of Scenic, it noted that the issue “presents difficult and close questions.” *Scenic I*, 983 F.Supp.2d at 172. When the FHWA later moved for summary judgment, therefore, Scenic was already on notice that its standing might be questioned on appeal, at which time the record would be closed. Scenic therefore cannot claim to have been deprived of a fair and “full opportunity to make a record of [its] standing in the district court.” *Swanson Grp.*

Mfg. LLC v. Jewell, 790 F.3d 235, 241 (D.C. Cir. 2015). Scenic should have accompanied its summary judgment materials with evidence of its standing. See *Lujan v. Nat’l Wildlife Fed’n*, 497 U.S. 871, 897, 110 S.Ct. 3177, 111 L.Ed.2d 695 (1990) (“[A] litigant’s failure to buttress its position because of confidence in the strength of that position is always indulged in at the litigant’s own risk.”).

Because the plaintiff has the burden to establish the evidentiary basis for its standing at the summary judgment stage *in every case*, just as it has the burden to plead sufficient facts at the motion to dismiss stage *in every case*, the District Court may wish to consider amending its local rules to provide that the plaintiff include its evidentiary basis for standing in the statement of material facts that every party is required to file either in support of, or in opposition to, a motion for summary judgment. See Civil Local Rule 7(h)(1). Such a rule would ensure that the plaintiff is on notice of its obligation to present such evidence, make the District Court’s job much easier (as well as ours), and function similarly to our Circuit Rule 28(a)(7), which we adopted after our ruling in *Sierra Club*.

*50 B.

1.

Scenic’s notice-and-comment claim turns on the redressability prong of Article III standing. Scenic asserts that the 2007 Guidance forced certain FHWA Division Offices to reinterpret the FSA lighting standards—that billboards may not contain “flashing, intermittent or moving” lights—so that those offices would thereafter find the FSA language to permit, rather than bar, digital billboards. Scenic claims that this alleged change of position made it easier for states to erect digital billboards, because they no longer had to worry about being prevented from doing so by the Division Offices. As a result, Scenic allegedly has to work harder, and thus spend greater resources, to fight these billboards—its injury in fact. Scenic claims that vacating the Guidance will redress that injury.

[12] [13] In this way, Scenic asserts injuries that stem not directly from the FHWA’s issuance of the 2007 Guidance, but from third parties not directly before the court—the Division Offices and the states. When “[t]he existence of one or more of the essential elements of standing”—

in this case redressability—“ ‘depends on the unfettered choices made by independent actors not before the courts and whose exercise of broad and legitimate discretion the courts cannot presume either to control or to predict,’ ” it becomes “ ‘substantially more difficult’ to establish” standing. *Defs. of Wildlife*, 504 U.S. at 562, 112 S.Ct. 2130 (quoting *ASARCO Inc. v. Kadish*, 490 U.S. 605, 615, 109 S.Ct. 2037, 104 L.Ed.2d 696 (1989); *Allen v. Wright*, 468 U.S. 737, 758, 104 S.Ct. 3315, 82 L.Ed.2d 556 (1984)); accord *Nat'l Wrestling Coaches Ass'n v. Dep't of Educ.*, 366 F.3d 930, 938 (D.C. Cir. 2004). “[M]ere ‘unadorned speculation’ as to the existence of a relationship between the challenged government action and the third-party conduct ‘will not suffice to invoke the federal judicial power.’ ” *Nat'l Wrestling*, 366 F.3d at 938 (quoting *Simon v. E. Ky. Welfare Rights Org.*, 426 U.S. 26, 44, 96 S.Ct. 1917, 48 L.Ed.2d 450 (1976)).

Scenic's complaint makes only two arguments concerning the redressability of its notice-and-comment claim. First, it argues that if we vacate the 2007 Guidance, “Scenic America and its affiliate members would spend fewer resources combating new digital billboards.” Compl. ¶ 21, J.A. 12. This speaks to Scenic's alleged organizational standing. See *PETA v. U.S. Dep't of Agric.*, 797 F.3d 1087, 1093 (D.C. Cir. 2015) (organizational standing “requires [an organizational plaintiff], like an individual plaintiff, to show actual or threatened injury in fact that is fairly traceable to the alleged illegal action and likely to be redressed by a favorable court decision” (internal quotation marks omitted)). Second, Scenic contends that if we vacate the 2007 Guidance, “digital billboards that injure Scenic America members would be subject to removal or an order to cease operating in a manner that violates the regulatory prohibition against intermittent lighting in billboard advertisements.” Compl. ¶ 21, J.A. 12. This speaks to Scenic's representational standing. See *Hunt v. Wash. State Apple Advert. Comm'n*, 432 U.S. 333, 343, 97 S.Ct. 2434, 53 L.Ed.2d 383 (1977) (recognizing “that an association has standing to bring suit on behalf of its members when: (a) its members would otherwise have standing to sue in their own right; (b) the interests it seeks to protect are germane to the organization's purpose; and (c) neither the claim asserted nor the relief requested requires the participation of individual members in the lawsuit”).

2.

a.

[14] Scenic has failed to demonstrate that our vacatur of the Guidance would *51 redress its alleged organizational injury—that it is forced to expend greater resources fighting digital billboards because the 2007 Guidance makes it easier for states to erect such billboards.

States are required to seek permission from the FHWA Division Offices before they permit the use of digital billboards. See 23 C.F.R. § 750.705(j). Prior to the FHWA's issuance of the Guidance, those Offices could, and often did, authorize that use, finding that it accorded with a given state's FSA. Scenic has introduced no evidence into the record—as it must at summary judgment—establishing that if we were to vacate the Guidance, any Division Office would respond by preventing the state it oversees from erecting digital billboards; nor has Scenic submitted evidence establishing that states would successfully erect, or even seek to erect, fewer billboards. Without providing any indication that our vacatur of the Guidance will diminish the number of billboards Scenic has to fight, Scenic has failed to demonstrate that its requested remedy would prevent Scenic from having to expend the same amount of resources fighting these billboards.

A brief look at some of our previous decisions in this area reinforces the point. In *National Wrestling*, we assessed the standing of several associations representing men's wrestling teams, some of whom had been cut from college athletic programs. 366 F.3d at 933. Department of Education regulations, promulgated under Title IX, required college athletic programs to ensure that they provided equal athletic opportunities to both sexes, based in part on the resources that are devoted to various programs. *Id.* at 934–35. Plaintiffs did not challenge those regulations. Instead, plaintiffs challenged a Department of Education interpretation of those regulations, which they claimed caused several athletic programs to eliminate their wrestling teams. *Id.* We held that plaintiffs lacked standing because they were unable to show that a favorable decision would redress their injuries. *Id.* at 938.

We noted that the “direct causes of appellants’ asserted injuries—loss of collegiate-level wrestling opportunities for male student-athletes—are the independent decisions of educational institutions.” *Id.* at 936–37. Even if we vacated the Department of Education’s interpretation, there was no indication that it would alter those institutions’ independent decisions to eliminate their wrestling teams. *Id.* at 939. Nothing in the Department’s interpretation required schools to eliminate their wrestling teams; schools did so in an attempt to ensure that they were distributing athletic resources equally—a requirement of Title IX more generally, irrespective of the interpretation that plaintiffs challenged. *See id.* at 939–40 (asserting that “nothing but speculation suggest[ed] that schools would act any differently” if the court vacated the interpretation). We noted that plaintiffs would only meet standing requirements if they “took the position that gender-conscious elimination of men’s sports teams would be illegal in the absence of the challenged” interpretation, but that plaintiffs made no such claim. *Id.* at 941. Finally, we explained that the “possibility” that wrestling teams would have “better odds” if we vacated the Department’s interpretation “falls far short of the mark.” *Id.* at 942 (emphasis omitted).

We held similarly in *Renal Physicians Ass’n v. United States Department of Health and Human Services*. 489 F.3d 1267 (D.C. Cir. 2007). That case involved the Stark Law, which limited the ability of a physician to refer a Medicare patient to clinical laboratories with which the physician had a “financial relationship,” but permitted *52 referrals where the physician’s only financial interest was the receipt of compensation at “fair market value.” *Id.* at 1269. The Department of Health and Human Services, which was authorized to promulgate regulations under the Law, created a “safe harbor” provision, describing two methods for demonstrating that a physician’s hourly rate was at fair market value. *Id.* at 1270. The Department also noted, however, that the safe harbor was voluntary, and that health care providers could continue to establish fair market value through other methods. *Id.* at 1269–71.

After a physicians’ association challenged the safe harbor provision under the APA, we held that plaintiff lacked standing because it failed to show that vacating the safe harbor provision would redress its members’ alleged injuries—namely that the safe harbor provision caused them to be paid less for their services than would otherwise be the case. *Id.* at 1276–78. Because the safe harbor

was merely one way that hospitals could determine “fair market value,” we noted that “it is ‘speculative,’ rather than ‘likely,’ that invalidating the safe harbor will somehow cause these facilities to pay more,” and that “[t]he effect (if any) of the safe harbor cannot be simply undone.” *Id.* at 1277.

As in *Renal Physicians*, the FHWA created what is, in essence, a safe harbor provision regarding digital billboards. The 2007 Guidance made it clear that state laws and regulations regarding digital billboards meeting the specifications listed in the Guidance would not be rejected for violating the FSA lighting standards. Yet even after the Guidance, Division Offices can still approve state laws and regulations permitting billboards that fall outside those specifications, and they can still reject laws and regulations allowing billboards that meet those specifications, but that violate state FSAs for other reasons. The safe harbor created by the Guidance is voluntary in the same way as the safe harbor in *Renal Physicians*; Division Offices can rely on it to find certain billboards permissible, but those Offices can find those billboards permissible for other reasons as well. It is “speculative,” rather than “likely,” that invalidating the Guidance would stop any particular billboard from being constructed. Indeed, many states with FSAs that included a ban on intermittent, flashing, or moving lights permitted digital billboards prior to the 2007 Guidance.

In sum, we cannot assume, without more, that vacating the Guidance would eliminate or lessen the construction of digital billboards.

Scenic contends that because the Texas Division Office barred Texas from constructing digital billboards prior to the Guidance, vacating the Guidance would redress Scenic’s injuries, at least with respect to Texas. However, Scenic has introduced no evidence suggesting that Texas, or the Texas Division Office, would behave any differently in the absence of the 2007 Guidance. Scenic simply assumes, without any proof, that Texas will revert to its pre-Guidance position as soon as the Guidance is invalidated.

Scenic’s assumption is nothing more than “unadorned speculation.” *Simon*, 426 U.S. at 44, 96 S.Ct. 1917. Several other possibilities seem just as likely, were we to vacate the 2007 Guidance. The Guidance may have focused the Texas Division Office on the fact that a majority of states

had already determined that the FSA lighting standards permitted digital billboards. Knowing as much, Texas's Division Office might be more inclined to “jump on the bandwagon” and permit such billboards going forward, even absent the 2007 Guidance. Or the Division Office might be persuaded to continue allowing digital billboards now that Texas has already *53 issued permits for at least 150 of them, Lloyd Decl. ¶ 9, J.A. 41. See *Renal Physicians*, 489 F.3d at 1278 (“[T]he word is already out, and therefore it is too late to reverse course.... [T]he undoing of the governmental action will not undo the harm, because the new status quo is held in place by other forces.”).

Scenic has introduced no evidence that would make any one of these possibilities more likely than another. Particularly given the difficulty of establishing standing based on the actions of third parties not before the Court, see *Defs. of Wildlife*, 504 U.S. at 562, 112 S.Ct. 2130, Scenic's lack of any evidentiary basis for its redressability contentions requires us to reject its standing as to its notice-and-comment claim.

As a final argument, Scenic relies on *Village of Arlington Heights v. Metropolitan Housing Development Corp.*, 429 U.S. 252, 97 S.Ct. 555, 50 L.Ed.2d 450 (1977), and contends that vacating the 2007 Guidance would remove one of several barriers to Scenic's anti-digital billboard efforts, and that this is sufficient for redressability purposes. However, *Arlington Heights* is inapposite here.

As an initial matter, *Arlington Heights* involved a party directly harmed by the challenged action, not one harmed by the actions of a third party not before the Court. See *id.* at 254, 97 S.Ct. 555. Moreover, *Arlington Heights* involved a developer's challenge to a zoning ordinance that prevented it from building low-income housing. *Id.* at 255–58, 97 S.Ct. 555. The Supreme Court characterized the zoning ordinance as an “absolute barrier.” *Id.* at 261, 97 S.Ct. 555. Although the developer still needed to secure financing and qualify for federal subsidies, the challenged zoning ordinance ensured that the developer could not proceed with its goal of constructing low-income housing. *Id.* at 261–62, 97 S.Ct. 555. A court decision to remove that barrier would redress the developer's injury because a major impediment to the developer's efforts would be eliminated.

Scenic has introduced no evidence showing that vacating the 2007 Guidance would remove an “absolute barrier”

to its efforts. As we have already stated above, absent the 2007 Guidance, states remain free to pursue digital billboard construction, and Division Offices remain free to permit such construction. Thus, Scenic has not established that invalidating the Guidance would improve or ease Scenic's efforts in any way.⁴

⁴ Scenic did not argue that the FHWA's failure to undertake notice and comment before promulgating the Guidance constitutes a procedural injury, and we express no opinion on such an argument. Although a party cannot forfeit a claim that we lack jurisdiction, it can forfeit a claim that we possess jurisdiction. See *Huron v. Cobert*, 809 F.3d 1274, 1279–80 (D.C. Cir. 2016).

b.

Scenic's representational standing claim fares no better. Scenic argues that vacating the 2007 Guidance will redress its members' injuries because it will cause the digital billboards allegedly injuring those members to be removed. Compl. ¶ 21, J.A. 12. Scenic came dangerously close to forfeiting this argument. See *Huron v. Cobert*, 809 F.3d 1274, 1279–80 (D.C. Cir. 2016).

Presumably because the District Court had upheld Scenic's standing at the motion to dismiss stage, and Defendants had not contested Scenic's standing before the District Court at the summary judgment stage, Scenic did not address its standing in its opening brief on appeal. In their responding brief, however, the FHWA challenged anew Scenic's standing. The FHWA contended that Scenic had offered “no basis for expecting that vacating the *54 Guidance would cause any existing digital billboards to be dismantled.” See FHWA Br. 29. In reply, Scenic appeared to abandon the allegation. It repeated the FHWA's contention and responded that “Plaintiff need only show that vacatur would reduce Plaintiff's continuing injury of diverting limited resources to counteract billboard approvals.” Reply Br. for Appellant 10.

Nonetheless, Scenic appears to have preserved its representational standing argument by painting it in a somewhat different light. It argues that the alleged injuries of one of its members—Nikki Laliberte—are “traceable to the Guidance” because the Guidance prohibits the Division Office in Minnesota, where Laliberte lives, from considering whether digital billboards violate the

FSA lighting standards. *See* Reply Br. for Appellant 12. Scenic's implication seems to be that vacating the Guidance might cause Minnesota's Division Office to remove some digital billboards. Although Scenic's argument is couched in terms of causation, "causation and redressability are closely related, and can be viewed as two facets of a single requirement." *Newdow v. Roberts*, 603 F.3d 1002, 1012 n.6 (D.C. Cir. 2010) (internal quotation marks omitted). Thus, Scenic's assertion is sufficient to preserve its representational standing claim.

As we noted above, however, Scenic has introduced no evidence demonstrating that our vacatur of the Guidance would cause Division Offices or states to prohibit the construction of new digital billboards. *See supra* Part II.B.2.a. It is even less plausible, given Scenic's complete lack of any evidentiary showing on the matter, that Division Offices or states would require extant billboards to be dismantled.

By neglecting to "set forth by affidavit or other evidence specific facts" establishing its representational standing, *Defs. of Wildlife*, 504 U.S. at 561, 112 S.Ct. 2130 (internal quotation marks omitted), Scenic has failed to meet its burden to demonstrate its representational standing to bring its notice-and-comment claim.

3.

Scenic does fare better, however—at least as to standing—on its claim that the Guidance violated § 706, although barely.

a.

In its complaint, Scenic alleges that FHWA's actions, in promulgating the Guidance, are "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, in violation of the APA." Compl. ¶ 62, J.A. 19. That language appears to be taken from § 706(2)(A) of the APA, which sets forth the well-known "arbitrary and capricious" standard, and which would likely provide an effective cause of action for Scenic to challenge the FHWA's alleged failure to comport with the HBA. Confusingly, however, Scenic does not cite § 706 as part of its second claim, but rather cites § 553, the provision

that concerns notice-and-comment rulemaking. *See id.* ¶¶ 57-62, J.A. 18-19.

Construing the complaint liberally, as is sometimes appropriate, *but cf. Settles v. U.S. Parole Comm'n*, 429 F.3d 1098, 1104, 1106 (D.C. Cir. 2005) (explaining that although "the complaint—particularly a complaint filed by a pro se prisoner—should be construed liberally," "the rule of liberal construction of complaints applies to factual allegations," and refusing to liberally construe a counseled plaintiff's complaint so as to include new defendants (quoting *Fletcher v. District of Columbia*, 370 F.3d 1223, 1227 n.* (D.C. Cir. 2004))), it might be possible to construe Scenic's complaint as having relied upon § 706 rather than, or in addition to, § 553. At oral argument, however, counsel for Scenic was specifically asked whether its second *55 claim included a § 706 challenge to FHWA's promulgation of the guidance, and Scenic's counsel replied "no, we did not present that." Counsel went on to state that to the extent it brought anything resembling an arbitrary-and-capricious challenge it did it through the "backdoor" of its notice-and-comment claim, specifically highlighting its argument that that the Guidance is a legislative rule because it is 180 degrees counter to the FSA text it alleged to be interpreting. Thus, it appears that Scenic disclaimed any arbitrary-and-capricious challenge to FHWA's alleged failure to comport with the HBA.

Nonetheless, during that same colloquy at oral argument, Scenic did state, with respect to its § 706 claim, that it "focused solely on the customary use provision, finding that it was contrary to law." Giving Scenic the benefit of the doubt, Scenic's papers and statements at oral argument are sufficient for us to eke out a § 706 claim.

b.

[15] Scenic has standing to bring such a § 706 claim. First, Scenic has offered sufficient evidence that it has suffered a representational injury in fact. The record at summary judgment demonstrates that at least one of its members, Nikki Laliberte, has suffered a concrete injury because a digital billboard near her home "generates a bright flash when its display transitions from one advertisement to another." Laliberte Decl. ¶ 4, J.A. 52. She asserts that the billboard "has marred the view from [her] home[]," and that she is "concerned that the billboard has negatively

affected the value of [her] property.” *Id.* ¶¶ 6, 9, J.A. 52-53. This sort of harm to an individual's property is sufficient to constitute a concrete injury in fact. *See Idaho, By & Through Idaho Pub. Utils. Comm'n v. ICC*, 35 F.3d 585, 591 (D.C. Cir. 1994) (noting that a private landowner “suffers concrete injury if [her] property is despoiled”).

[16] The causation and redressability prongs of our standing analysis are equally clear here. Scenic's § 706 claim is that the Guidance runs afoul of the statute's “customary use” requirement as that requirement has been interpreted in the FSAs. If we were to find for Scenic on the merits of its claim, a point we must assume for standing purposes, *see LaRoque v. Holder*, 650 F.3d 777, 785 (D.C. Cir. 2011), we could only do so by effectively repudiating the FHWA's interpretation of the FSAs. Repudiation would provide much more robust relief than vacatur. Not only would it prohibit the agency from relying on that interpretation in any future rulemakings, it would also require the agency to subject extant billboards to either removal or an order requiring those billboards to operate in a manner that does not violate the FSAs, for instance by keeping the image displayed by the billboard constant and unchanging. Scenic's injury, clearly caused by the Guidance, is therefore redressable. *See Renal Physicians*, 489 F.3d at 1278 (holding that “the only way to prevent” a finding that redressability is lacking in the third-party context is “for a court not only to invalidate [the contested agency action] but also to repudiate” it).

III.

FHWA argues that the Guidance is not a final agency action and is therefore not reviewable under the APA. We disagree.

[17] An agency action will be deemed final if it “mark[s] the consummation of the agency's decisionmaking process” and is an action “by which rights or obligations have been determined, or from which legal consequences will flow.” *Bennett v. Spear*, 520 U.S. 154, 177–78, 117 S.Ct. 1154, 137 L.Ed.2d 281 (1997) (internal quotation *56 marks omitted). “The most important factor” in determining whether an agency action is one “from which legal consequences will flow” “concerns the actual legal effect (or lack thereof) of the agency action in question on regulated entities.” *Nat'l Mining Ass'n v. McCarthy*, 758 F.3d 243, 252 (D.C. Cir. 2014).

[18] The Guidance marks the consummation of FHWA's decision-making process. It comes to a definitive conclusion: the FSA's prohibition on “flashing, intermittent or moving” lights does not prevent states from permitting digital billboards, so long as they meet certain prescribed requirements. Although the Guidance does state that the FHWA “may provide further guidance in the future as a result of additional information” FHWA might receive, J.A. 535, such a statement is fairly read as a “boilerplate” indication that the agency may issue further interpretations in the future. *See Appalachian Power Co. v. EPA*, 208 F.3d 1015, 1022–23 (D.C. Cir. 2000). The fact that a regulation might be interpreted again at some point in the indeterminate future cannot, by itself, prevent the initial interpretation from being final.

The Guidance is also an action “from which legal consequences will flow.” It creates a safe harbor such that Division Offices and states may not deny a digital billboard permit for violating the FSA lighting standards where that billboard meets the timing and other requirements set forth in the Guidance. In this way, the Guidance withdraws some of the discretion concerning billboard permitting the Division Offices and states previously held. *See NRDC v. EPA*, 643 F.3d 311, 320 (D.C. Cir. 2011) (concluding that where agency action withdraws an entity's previously-held discretion, that action “alter[s] the legal regime,” “binds” the entity, “and thus qualifies as final agency action”). That safe harbor has a clear legal effect on the regulated entities here—the Division Offices and the states—and the Guidance is therefore a final agency action.

IV.

Having concluded that Scenic has standing to bring its § 706 claim, and that the Guidance constitutes final agency action, we now review the merits of the claim *de novo*, *see Khan v. Parsons Glob. Servs., Ltd.*, 428 F.3d 1079, 1082 (D.C. Cir. 2005), and find them lacking.

Scenic argues that the Guidance is invalid because it fails to comport with the HBA's “customary use” provision. That provision states that “signs, displays, and devices whose size, lighting and spacing, *consistent with customary use* is to be determined by agreement between the several States and the Secretary, may be erected” within 660 feet

of the Interstate. 23 U.S.C. § 131(d) (emphasis added). Scenic contends that the FHWA, in issuing the Guidance, changed the FSA lighting standards to such an extent that those standards are no longer “consistent with customary use.” According to Scenic “[a]nything outside the scope of what an FSA meant at the time it was created cannot be ‘customary use.’” Opening Br. for Appellant 36.

In *Cajun Electric Power Cooperative, Inc. v. FERC*, we clarified that

[a]ny agreement that must be filed and approved by an agency loses its status as a strictly private contract and takes on a public interest gloss. That means that when the agency reconciles ambiguity in such a contract it is expected to do so by drawing upon its view of the public interest. And, therefore, the agency to which Congress entrusted the protection and discharge of the public interest is entitled to just as much benefit of the doubt in interpreting such an agreement as it would in interpreting its own orders, *57 its regulations, or its authorizing statute.

924 F.2d 1132, 1135 (D.C. Cir. 1991) (internal citations omitted); see also *Nat'l Fuel Gas Supply Corp. v. FERC*, 811 F.2d 1563, 1569–71 (D.C. Cir. 1987) (treating an agency interpretation of a settlement agreement as entitled to deference similar to that owed under *Chevron* where the settlement agreement had to be approved by the agency). The FSAs, as agreements between the FHWA and individual states, see 23 U.S.C. § 131(d), were thus approved by the FHWA as described in *Cajun Electric*.

Further, as the District Court explained, “[b]oth Defendants and Scenic America recognize ... that all FSA lighting provisions were established consistent with customary use.” *Scenic II*, 49 F.Supp.3d at 71 (quoting or citing both parties' briefing) (internal quotation marks omitted); see also Opening Br. for Appellant 36; FHWA Br. 51-52. Thus, so long as the FHWA has merely

interpreted in a reasonable fashion, rather than amended, those lighting standards, that interpretation must itself be “consistent with customary use,” whether or not it is precisely the interpretation that would have been given to the standards at the time the FHWA and states first agreed upon them. Cf. *Ass'n of Am. R.Rs. v. Surface Transp. Bd.*, 162 F.3d 101, 107 (D.C. Cir. 1998) (“Our deference to an agency's reasonable interpretation of its governing statute ‘is a product both of an awareness of the practical expertise which an agency normally develops, and of a willingness to accord some measure of flexibility to such an agency as it encounters new and unforeseen problems over time.’” (quoting *Int'l Bhd. of Teamsters v. Daniel*, 439 U.S. 551, 566 n.20, 99 S.Ct. 790, 58 L.Ed.2d 808 (1979))).

[19] We agree with the District Court's conclusion that the FHWA's interpretation of the FSA lighting standards is not one that “ ‘runs 180 degrees counter to the plain meaning of the’ FSAs,” and that it therefore “construes, rather than contradicts” the FSAs. *Scenic II*, 49 F.Supp.3d at 62–63, 70 (quoting *Nat'l Family Planning & Reprod. Health Ass'n v. Sullivan*, 979 F.2d 227, 235 (D.C. Cir. 1992)). Although it might be possible to read the FSA lighting standards to prohibit digital billboards, those standards do not foreclose other interpretations, including the FHWA's here. Because the FHWA's interpretation of the FSA lighting provision was reasonable, the interpretation cannot be “contrary to customary use.” Accordingly, Scenic's claim that the Guidance violates § 706 must fail.

For the foregoing reasons, we affirm the District Court's grant of summary judgment as to Scenic's § 706 claim, vacate its judgment as to Scenic's notice-and-comment claim, and remand with instructions to dismiss Scenic's notice-and-comment claim.

So ordered.

All Citations

836 F.3d 42

**DRIVER VISUAL BEHAVIOR IN THE PRESENCE OF COMMERCIAL
ELECTRONIC VARIABLE MESSAGE SIGNS (CEVMS)**

SEPTEMBER 2012



FHWA-HEP-16-036

FOREWORD

The advent of electronic billboard technologies, in particular the digital Light-Emitting Diode (LED) billboard, has necessitated a reevaluation of current legislation and regulation for controlling outdoor advertising. In this case, one of the concerns is possible driver distraction. In the context of the present report, outdoor advertising signs employing this new advertising technology are referred to as Commercial Electronic Variable Message Signs (CEVMS). They are also commonly referred to as Digital Billboards and Electronic Billboards.

The present report documents the results of a study conducted to investigate the effects of CEVMS used for outdoor advertising on driver visual behavior in a roadway driving environment. The report consists of a brief review of the relevant published literature related to billboards and visual distraction, the rationale for the Federal Highway Administration research study, the methods by which the study was conducted, and the results of the study, which used an eye tracking system to measure driver glances while driving on roadways in the presence of CEVMS, standard billboards, and other roadside elements. The report should be of interest to highway engineers, traffic engineers, highway safety specialists, the outdoor advertising industry, environmental advocates, Federal policymakers, and State and local regulators of outdoor advertising.

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Research and Development

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16. Abstract This study was conducted to investigate the effect of CEVMS on driver visual behavior in a roadway driving environment. An instrumented vehicle with an eye tracking system was used. Roads containing CEVMS, standard billboards, and control areas with no off-premise advertising were selected. Data were collected on arterials and freeways in the day and nighttime. Field studies were conducted in two cities where the same methodology was used but there were differences in the roadway visual environment. The gazes to the road ahead were high across the conditions; however, the CEVMS and billboard conditions resulted in a lower probability of gazes as compared to the control conditions (roadways not containing off-premise advertising) with the exception of arterials in Richmond where none of the conditions differed from each other. Examination of where drivers gazed in the CEVMS and standard billboard conditions showed that gazes away from the road ahead were not primarily to the billboards. Average and maximum fixations to CEVMS and standard billboards were similar across all conditions. However, four long dwell times were found (sequential and multiple fixations) that were greater than 2,000 ms. One was to a CEVMS on a freeway in the day time, two were to the same standard billboard on a freeway once in the day and once at night; and one was to a standard billboard on an arterial at night. In Richmond, the results showed that drivers gazed more at CEVMS than at standard billboards at night; however, in Reading the drivers were equally likely to gaze towards CEVMS or standard billboards in day and night. The results of the study are consistent with research and theory on the control of gaze behavior in natural environments. The demands of the driving task tend to affect the driver's self-regulation of gaze behavior.			
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APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yard	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in ²	poundforce per square inch	6.89	kilopascals	kPa
APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE (exact degrees)				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in ²
*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)				

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LIST OF ACRONYMS AND SYMBOLS

CEVMS	Commercial Electronic Variable Message Sign
EB	Empirical Bayes
DCZ	Data Collection Zone
ROI	Region of Interest
LED	Light-Emitting Diode
IR	Infra-Red
CCD	Charge-Coupled Device
MAPPS	Multiple-Analysis of Psychophysical and Performance Signals
GEE	Generalized Estimating Equations
FHWA	Federal Highway Administration
DOT	Department of Transportation

EXECUTIVE SUMMARY

This study examines where drivers look when driving past commercial electronic variable message signs (CEVMS), standard billboards, or no off-premise advertising. The results and conclusions are presented in response to the three research questions listed below:

1. Do CEVMS attract drivers' attention away from the forward roadway and other driving-relevant stimuli?
2. Do glances to CEVMS occur that would suggest a decrease in safety?
3. Do drivers look at CEVMS more than at standard billboards?

This study follows a Federal Highway Administration (FHWA) review of the literature on the possible distracting and safety effects of off-premise advertising and CEVMS in particular. The review considered laboratory studies, driving simulator studies, field research vehicle studies, and crash studies. The published literature indicated that there was no consistent evidence showing a safety or distraction effect due to off-premise advertising. However, the review also enumerated potential limitations in the previous research that may have resulted in the finding of no distraction effects for off-premise advertising. The study team recommended that additional research be conducted using instrumented vehicle research methods with eye tracking technology.

The eyes are constantly moving and they fixate (focus on a specific object or area), perform saccades (eye movements to change the point of fixation), and engage in pursuit movements (track moving objects). It is during fixations that we take in detailed information about the environment. Eye tracking allows one to determine to what degree off-premise advertising may divert attention away from the forward roadway. A finding that areas containing CEVMS result in significantly more gazes to the billboards at a cost of not gazing toward the forward roadway would suggest a potential safety risk. In addition to measuring the degree to which CEVMS may distract from the forward roadway, an eye tracking device would allow an examination of the duration of fixations and dwell times (multiple sequential fixations) to CEVMS and standard billboards. Previous research conducted by the National Highway Traffic Safety Administration (NHTSA) led to the conclusion that taking your eyes off the road for 2 seconds or more presents a safety risk. Measuring fixations and dwell times to CEVMS and standard billboards would also allow a determination as to the degree to which these advertising signs lead to potentially unsafe gaze behavior.

Most of the literature concerning eye gaze behavior in dynamic environments suggests that task demands tend to override visual salience (an object that stands out because of its physical properties) in determining attention allocation. When extended to driving, it would be expected that visual attention will be directed toward task-relevant areas and objects (e.g., the roadway, other vehicles, speed limit signs) and that other salient objects, such as billboards, would not necessarily capture attention. However, driving is a somewhat automatic process and conditions generally do not require constant, undivided attention. As a result, salient stimuli, such as CEVMS, might capture driver attention and produce an unwanted increase in driver distraction. The present study addresses this concern.

This study used an instrumented vehicle with an eye tracking system to measure where drivers were looking when driving past CEVMS and standard billboards. The CEVMS and standard billboards were measured with respect to luminance, location, size, and other relevant variables to characterize these visual stimuli extensively. Unlike previous studies on digital billboards, the present study examined CEVMS as deployed in two United States cities. These billboards did not contain dynamic video or other dynamic elements, but changed content approximately every 8 to 10 seconds. The eye tracking system had nearly a 2-degree level of resolution that provided significantly more accuracy in determining what objects the drivers were looking at compared to an earlier naturalistic driving study. This study assessed two data collection efforts that employed the same methodology in two cities.

In each city, the study examined eye glance behavior to four CEVMS, two on arterials and two on freeways. There were an equal number of signs on the left and right side of the road for arterials and freeways. The standard billboards were selected for comparison with CEVMS such that one standard billboard environment matched as closely as possible that of each of the CEVMS. Two control locations were selected that did not contain off-premise advertising, one on an arterial and the other on a freeway. This resulted in 10 data collection zones in each city that were approximately 1,000 feet in length (the distance from the start of the data collection zone to the point that the CEVMS or standard billboard disappeared from the data collection video).

In Reading, Pennsylvania, 14 participants drove at night and 17 drove during the day. In Richmond, Virginia, 10 participants drove at night and 14 drove during the day. Calibration of the eye tracking system, practice drive, and the data collection drive took approximately 2 hours per participant to accomplish.

The following is a summary of the study results and conclusions presented in reference to the three research questions the study aimed to address.

Do CEVMS attract drivers' attention away from the forward roadway and other driving relevant stimuli?

- On average, the drivers in this study devoted between 73 and 85 percent of their visual attention to the road ahead for both CEVMS and standard billboards. This range is consistent with earlier field research studies. In the present study, the presence of CEVMS did not appear to be related to a decrease in looking toward the road ahead.

Do glances to CEVMS occur that would suggest a decrease in safety?

- The average fixation duration to CEVMS was 379 ms and to standard billboards it was 335 ms across the two cities. The average fixation durations to CEVMS and standard billboards were similar to the average fixation duration to the road ahead.
- The longest fixation to a CEVMS was 1,335 ms and to a standard billboard it was 1,284 ms. The current widely accepted threshold for durations of glances away from the road ahead that result in higher crash risk is 2,000 ms. This value comes from a NHTSA

naturalistic driving study that showed a significant increase in crash odds when glances away from the road ahead were 2,000 ms or longer.

- Four dwell times (aggregate of consecutive fixations to the same object) greater than 2,000 ms were observed across the two studies. Three were to standard billboards and one was to a CEVMS. The long dwell time to the CEVMS occurred in the daytime to a billboard viewable from a freeway. Review of the video data for these four long dwell times showed that the signs were not far from the forward view while participant's gaze dwelled on them. Therefore, the drivers still had access to information about what was in front of them through peripheral vision.
- The results did not provide evidence indicating that CEVMS, as deployed and tested in the two selected cities, were associated with unacceptably long glances away from the road. When dwell times longer than the currently accepted threshold of 2,000 ms occurred, the road ahead was still in the driver's field of view. This was the case for both CEVMS and standard billboards.

Do drivers look at CEVMS more than at standard billboards?

- When comparing the probability of a gaze at a CEVMS versus a standard billboard, the drivers in this study were generally more likely to gaze at CEVMS than at standard billboards. However, some variability occurred between the two locations and between the types of roadway (arterial or freeway).
- In Reading, when considering the proportion of time spent looking at billboards, the participants looked more often at CEVMS than at standard billboards when on arterials (63 percent to CEVMS and 37 percent to a standard billboard), whereas they looked more often at standard billboards when on freeways (33 percent to CEVMS and 67 percent to a standard billboard). In Richmond, the drivers looked at CEVMS more than standard billboards no matter the type of road they were on, but as in Reading, the preference for gazing at CEVMS was greater on arterials (68 percent to CEVMS and 32 percent to standard billboards) than on freeways (55 percent to CEVMS and 45 percent to standard billboards). When a gaze was to an off-premise advertising sign, the drivers were generally more likely to gaze at a CEVMS than at a standard billboard.
- In Richmond, the drivers showed a preference for gazing at CEVMS versus standard billboards at night, but in Reading the time of day did not affect gaze behavior. In Richmond, drivers gazed at CEVMS 71 percent and at standard billboards 29 percent at night. On the other hand, in the day the drivers gazed at CEVMS 52 percent and at standard billboards 48 percent.
- In Reading, the average gaze dwell time for CEVMS was 981 ms and for standard billboards it was 1,386 ms. The difference in these average dwell times was not statistically significant. In contrast, the average dwell times to CEVMS and standard billboards were significantly different in Richmond (1,096 ms and 674 ms, respectively).

The present data suggest that the drivers in this study directed the majority of their visual attention to areas of the roadway that were relevant to the task at hand (e.g., the driving task). Furthermore, it is possible, and likely, that in the time that the drivers looked away from the forward roadway, they may have elected to glance at other objects in the surrounding environment (in the absence of billboards) that were not relevant to the driving task. When billboards were present, the drivers in this study sometimes looked at them, but not such that overall attention to the forward roadway decreased.

It also should be noted that, like other studies in the available literature, this study adds to the knowledge base on the issues examined, but does not present definitive answers to the research questions investigated.

INTRODUCTION

“The primary responsibility of the driver is to operate a motor vehicle safely. The task of driving requires full attention and focus. Drivers should resist engaging in any activity that takes their eyes and attention off of the road for more than a couple of seconds. In some circumstances even a second or two can make all the difference in a driver being able to avoid a crash.” – US Department of Transportation⁽¹⁾

The advent of electronic billboard technologies, in particular the digital Light-Emitting Diode (LED) billboard, has prompted a reevaluation of regulations for controlling outdoor advertising. An attractive quality of these LED billboards, which are hereafter referred to as Commercial Electronic Variable Message Signs (CEVMS), is that advertisements can change almost instantly. Furthermore, outdoor advertising companies can make these changes from a central remote office. Of concern is whether or not CEVMS may attract drivers’ attention away from the primary task (driving) in a way that compromises safety.

The current Federal Highway Administration (FHWA) guidance recommends that CEVMS should not change content more frequently than once every 8 seconds.⁽²⁾ However, according to Scenic America, the basis of the safety concern is that the “...distinguishing trait...” of a CEVMS “... is that it can vary while a driver watches it, in a setting in which that variation is likely to attract the drivers’ attention away from the roadway.”⁽³⁾ This study was conducted to provide the FHWA with data to determine if CEVMS capture visual attention differently than standard off-premise advertising billboards.

BACKGROUND

A 2009 review of the literature by Molino et al. for the FHWA failed to find convincing empirical evidence that CEVMS, as currently implemented, constitutes a safety risk greater than that of conventional vinyl billboards.⁽⁴⁾ A great deal of work has been focused in this area, but the findings of these studies have been mixed.^(4,5) A summary of the key past findings is presented here, but the reader is referred to Molino et al. for a comprehensive review of studies prior to 2008.⁽⁴⁾

Post-Hoc Crash Studies

Post-hoc crash studies use reviews of police traffic collision reports or statistical summaries of such reports in an effort to understand the causes of crashes that have taken place in the vicinity of some change to the roadside environment. In the present case, the change of concern is the introduction of CEVMS to the roadside or the replacement of conventional billboards with CEVMS.

The literature review conducted by Molino et al. did not find compelling evidence for a distraction effect attributable to CEVMS.⁽⁴⁾ The authors concluded that all post-hoc crash studies are subject to certain weaknesses, most of which are difficult to overcome. For example, the vast majority of crashes are never reported to police; thus, such studies are likely to underreport crashes. Also, when crashes are caused by factors such as driver distraction or inattention, the involved driver may be unwilling or unable to report these factors to a police investigator.

Another weakness is that police, under time pressure, are rarely able to investigate the true root causes of crashes unless they involve serious injury, death, or extensive property damage. Furthermore, to have confidence in the results, such studies need to collect comparable data before and after the change, and, in the after phase, at equivalent but unaffected roadway sections. Since crashes are infrequent events, data collection needs to span extended periods of time both before and after introduction of the change. Few studies are able to obtain such extensive data.

Two recent studies by Tantala and Tantala examined the relationship between the presence of CEVMS and crash statistics in Richmond, Virginia, and Reading, Pennsylvania.^(6,7) For the Richmond area, 7 years of crash data at 10 locations with CEVMS were included in the analyses. The study used a before-after methodology where most sites originally contained vinyl billboards (before) that were converted to CEVMS (after). The quantity of crash data was not the same for all locations and ranged from 1 year before/after to 3 years before/after. The study employed the Empirical Bayes (EB) method to analyze the data.⁽⁸⁾ The results indicated that the total number of crashes observed was consistent with what would be statistically expected with or without the introduction of CEVMS. The analysis approach for Reading locations was much the same as for Richmond other than there were 20 rather than 10 CEVMS and 8 years of crash statistics. The EB method showed results for Reading that were very similar to those of Richmond.

The studies by Tantala and Tantala appear to address many of the concerns from Molino et al. regarding the weaknesses and issues associated with crash studies.^(4,6,7) For example, they include crash comparisons for locations within multiple distances of each CEVMS to address concerns about the visual range used in previous analyses. They used EB analysis techniques to correct for regression-to-mean bias. Also, the EB method would better reflect crash rate changes due to changes in average daily traffic and the interactions of these with the roadway features that were coded in the model. The studies followed approaches that are commonly used in post-hoc crash studies, though the results would have been strengthened by including before-after results for non-CEVMS locations as a control group.

Field Investigations

Field investigations include unobtrusive observation, naturalistic driving studies, on-road instrumented vehicle investigations, test track experiments, driver interviews, surveys, and questionnaires. The following focuses on relevant studies that employed naturalistic driving and on-road instrumented vehicle research methods.

Lee, McElheny, and Gibbons undertook an on-road instrumented vehicle study on Interstate and local roads near Cleveland, Ohio.⁽⁹⁾ The study looked at driver glance behavior in the vicinity of digital billboards, conventional billboards, comparison sites (sites with buildings and other signs, including digital signs), and control sites (those without similar signage). The results showed that there were no differences in the overall glance patterns (percent eyes-on-road and overall number of glances) between the different sites. Drivers also did not glance more frequently in the direction of digital billboards than in the direction of other event types (conventional billboards, comparison events, and baseline events) but drivers did take longer glances in the direction of digital billboards and comparison sites than in the direction of conventional billboards and baseline sites. However, the mean glance length toward the digital billboards was less than

1,000 ms. It is important to note that this study employed a video-based approach for examining drivers' visual behavior, which has an accuracy of no better than 20 degrees.⁽¹⁰⁾ While this technique is likely to be effective in assessing gross eye movements and looks that are away from the road ahead, it may not have sufficient resolution to discriminate what specific object the driver is looking at outside of the vehicle.

Beijer, Smiley, and Eizenman evaluated driver glances toward four different types of roadside advertising signs on roads in the Toronto, Canada, area.⁽¹¹⁾ The four types of signs were: (a) billboard signs with static advertisements; (b) billboard advertisements placed on vertical rollers that could rotate to show one of three advertisements in succession; (c) scrolling text signs with a minor active component, which usually consisted of a small strip of lights that formed words scrolling across the screen or, in some cases, a larger area capable of displaying text but not video; and (d) signs with video images that had a color screen capable of displaying both moving text and moving images. The study employed an on-road instrumented vehicle with a head-mounted eye tracking device. The researchers found no significant differences in average glance duration or the maximum glance duration for the various sign types; however, the number of glances was significantly lower for billboard signs than for the roller bar, scrolling text, and video signs.

Smiley, Smahel, and Eizenman conducted a field driving study that employed an eye tracking system that recorded drivers' eye movements as participants drove past video signs located at three downtown intersections and along an urban expressway.⁽¹²⁾ The study route included static billboards and video advertising. The results of the study showed that on average 76 percent of glances were to the road ahead. Glances at advertising, including static billboards and video signs, constituted 1.2 percent of total glances. The mean glance durations for advertising signs were between 500 ms and 750 ms, although there were a few glances of about 1,400 ms in duration. Video signs were not more likely than static commercial signs to be looked at when headways were short; in fact, the reverse was the case. Furthermore, the number of glances per individual video sign was small, and statistically significant differences in looking behavior were not found.

Kettwich, Kartsen, Klinger, and Lemmer conducted a field study where drivers' gaze behavior was measured with an eye tracking system.⁽¹³⁾ Sixteen participants drove an 11.5 mile (18.5 km) route comprised of highways, arterial roads, main roads, and one-way streets in Karlsruhe, Germany. The route contained advertising pillars, event posters, company logos, and video screens. Mean gaze duration for the four types of advertising was computed for periods when the vehicle was in motion and when it was stopped. Gaze duration while driving for all types of advertisements was under 1,000 ms. On the other hand, while the vehicle was stopped, the mean gaze duration for video screen advertisements was 2,750 ms. The study showed a significant difference between gaze duration while driving and while stationary: gaze duration was affected by the task at hand. That is, drivers tended to gaze longer while the car was stopped and there were few driving task demands.

The previously mentioned studies estimated the duration of glances to advertising and computed mean values of less than 1,000 ms. Klauer et al., in his analysis of the 100-Car Naturalistic Driving Study, concluded that glances away from the roadway for any purpose lasting more than 2,000 ms increase near-crash/crash risk by at least two times that of normal, baseline driving.⁽¹⁴⁾

Klauer et al. also indicated that short, brief glances away from the forward roadway for the purpose of scanning the driving environment are safe and actually decrease near-crash/crash risk.⁽¹⁴⁾ Using devices in a vehicle that draw visual attention away from the forward roadway for more than 2,000 ms (e.g., texting) is incompatible with safe driving. However, for external stimuli, especially those near the roadway, the evaluation of eye glances with respect to safety is less clear since peripheral vision would allow the driver to still have visual access to the forward roadway.

Laboratory Studies

Laboratory investigations related to roadway safety can be classified into several categories: driving simulations, non-driving-simulator laboratory testing, and focus groups. The review of relevant laboratory studies by Molino et al. did not show conclusive evidence regarding the distracting effects of CEVMS.⁽⁴⁾ Moreover, the authors concluded that present driving simulators do not have sufficient visual dynamic range, image resolution, and contrast ratio capability to produce the compelling visual effect of a bright, photo-realistic LED-based CEVMS against a natural background scene. The following is a discussion of a driving simulator study conducted after the publication of Molino et al.⁽⁴⁾ The study focused on the effects of advertising on driver visual behavior.

Chattington, Reed, Basacik, Flint, and Parkes conducted a driving simulator study in the United Kingdom (UK) to evaluate the effects of static and video advertising on driver glance behavior.⁽¹⁵⁾ The researchers examined the effects of advertisement position relative to the road (left, right, center on an overhead gantry, and in all three locations simultaneously), type of advertisement (static or video), and exposure duration of the advertisement. (The paper does not provide these durations in terms of time or distance. The exposure duration had to do with the amount of time or distance that the sign would be visible to the driver.) For the advertisements presented on the left side of the road (recall that drivers travel in the left lane in the UK), mean glance durations for static and video advertisements were significantly longer (approximately 650 to 750 ms) when drivers experienced long advertisement exposure as opposed to medium and short exposures. Drivers looked more at video advertisements (about 2 percent on average of the total duration recorded) than at static advertisements (about 0.75 percent on average). In addition, the location of the advertisements had an effect on glance behavior. When advertisements were located in the center of the road or in all three positions simultaneously, the glance durations were about 1,000 ms and were significantly longer than for signs placed on the right or left side of the road. For advertisements placed on the left side of the road, there was a significant difference in glance duration between static (about 400 ms) and video (about 800 ms). Advertisement position also had an effect on the proportion of time that a driver spent looking at an advertisement. The percentage of time looking at advertisements was greatest when signs were placed in all three locations, followed by center location signs, then the left location signs, and finally the right location signs. Drivers looked more at the video advertisements relative to the static advertisements when they were placed in all three locations, placed on the left, and placed on the right side of the road. The center placement did not show a significant difference in percent of time spent looking between static and video.

Summary

The results from these key studies offer some insight into whether CEVMS pose a visual distraction threat. However, these same studies also reveal some inconsistent findings and potential methodological issues that are addressed in the current study. The studies conducted by Smiley et al. showed drivers glanced forward at the roadway about 76 percent of the time in the presence of video and dynamic signs where a few long glances of approximately 1,400 ms were observed.⁽¹²⁾ However, the video and dynamic signs used in these studies portray moving objects that are not present in CEVMS as deployed in the United States. In another field study employing eye tracking, Kettwich et al. found that gaze duration while driving for all types of advertisements that they evaluated was less than 1,000 ms; however, when the vehicle was stopped, mean gaze duration for advertising was as high as 2,750 ms.⁽¹⁶⁾ Collectively, these studies did not demonstrate that the advertising signs detracted from drivers' glances forward at the roadway in a substantive manner while the vehicle was moving.

In contrast, the simulator study by Chattington et al. demonstrated that dynamic signs showing moving video or other dynamic elements may draw attention away from the roadway.⁽¹⁵⁾ Furthermore, the location of the advertising sign on the road is an important factor in drawing drivers' visual attention. Advertisements with moving video placed in the center of the roadway on an overhead gantry or in all three positions (right, left, and in the center) simultaneously are very likely to draw glances from drivers.

Finally, in a study that examined CEVMS as deployed in the United States, Lee et al. did not show any significant effects of CEVMS on driver glance behavior.⁽⁹⁾ However, the methodology that was used likely did not employ sufficient sensitivity to determine at what specific object in the environment a driver was looking.

None of these studies combined all necessary factors to address the current CEVMS situation in the United States. Those studies that used eye tracking on real roads had animated and video-based signs, which are not reflective of current off-premise CEVMS practice in the United States.

STUDY APPROACH

Based on an extensive review of the literature, Molino et al. concluded that the most effective method to use in an evaluation of the effects of CEVMS on driver visual behavior was the instrumented field vehicle method that incorporated an eye tracking system.⁽⁴⁾ The present study employed such an instrumented field vehicle with an eye tracking system and examined the degree to which CEVMS attract drivers' attention away from the forward roadway.

The following presents a brief overview and discussion of studies using eye tracking methodology with complex visual stimuli, especially in natural environments (walking, driving, etc.). The review by Molino et al. recommended the use of this type of technology and method; however, a discussion laying out technical and theoretical issues underlying the use of eye tracking methods was not presented.⁽⁴⁾ This background is important for the interpretation of the results of the studies conducted here.

Standard and digital billboards are often salient stimuli in the driving environment, which may make them conspicuous. Cole and Hughes define attention conspicuity as the extent to which a stimulus is sufficiently prominent in the driving environment to capture attention. Further, Cole and Hughes state that attention conspicuity is a function of size, color, brightness, contrast relative to surroundings, and dynamic components such as movement and change.⁽¹⁷⁾ It is clear that under certain circumstances image salience or conspicuity can provide a good explanation of how humans orient their attention.

At any given moment a large number of stimuli reach our senses, but only a limited number of them are selected for further processing. In general, attention can be focused on a stimulus because it is important for achieving some goal, or because the properties of the stimulus can attract the attention of the observer independent of their intentions (e.g., a car horn may elicit an orienting response). When the focus of attention is goal directed, it is referred to as top-down. When the focus of attention is principally a function of stimulus attributes, it is referred to as bottom-up.⁽¹⁸⁾

In general, billboards (either standard or CEVMS) are not relevant to the driving task but are presumably designed to be salient stimuli in the environment where they may draw a driver's attention. The question is to what degree CEVMS draw a driver's attention away from driving-relevant stimuli (e.g., road ahead, mirrors, and speedometer) and is this different from a standard billboard? In his review of the literature Wachtel leads one to consider CEVMS as stimuli in the environment where attention to them would be drawn in a bottom-up manner; that is, the salience of the billboards would make them stand out relative to other stimuli in the environment and drivers would reflexively look at these signs.⁽¹⁹⁾ Wachtel's conclusions were in reference to research by Theeuwes who employed simple letter stimulus arrays in a laboratory task.⁽²⁰⁾ Research using simple visual stimuli in a laboratory environment are very useful for testing different theories of perception, but often lack direct application to tasks such as driving. The following discusses research using complex visual stimuli and tasks that are more relevant to natural vision as experienced in the driving task.

A recent review of stimulus salience and eye guidance by Tatler et al. shows that most of the evidence for the capture of attention by the conspicuity of stimuli comes from research in which the stimulus is a simple visual search array or in which the target is uniquely defined by simple visual features.⁽²¹⁾ In other words, these are laboratory studies that use letters, arrays of letters, or simple geometric patterns as the stimuli. Pure salience-based models are capable of predicting eye movement endpoint in simple displays, but are less successful for more complex scenes that contain task-relevant and task-irrelevant salient areas.^(22,23)

Research by Henderson et al. using photographs of actual scenes showed that subjects looked at non-salient scene regions containing a search target and rarely looked at salient non-task-relevant regions of the scenes.⁽²⁴⁾ Salience of the stimulus alone was not a good predictor of where participants looked. Additional research by Henderson using photographs of real world scenes also showed that subjects fixated on regions of the pictures that provided task-relevant information rather than visually salient regions with no task-relevant information. However, Henderson acknowledges that static pictures have many shortcomings when used as surrogates for real environments.⁽²⁵⁾

Land's review of eye movements in dynamic environments concluded that the eyes are proactive and typically seek out information required in the second before each new activity commences.⁽²⁶⁾ Specific tasks (e.g., driving) have characteristic but flexible patterns of eye movement that accompany them, and these patterns are similar between individuals. Land concluded that the eyes rarely visit objects that are irrelevant to the task, and the conspicuity of objects is less important than the objects' roles in the task. In a subsequent review of eye movement and natural behavior, Land concluded that in a task that requires fixation on a sequence of specific objects, the capture of gaze by irrelevant salient objects would, in general, be an obtrusive nuisance.⁽²²⁾

The literature examining gaze control under natural behavior suggests that it is principally top-down driven, or intentional.^(24,25,26,22,21,27) However, top-down processing does not explain all gaze control or eye movements. For example, imagine driving down a two-lane country road and a deer jumps into the road. It is most likely that you will attend and react to this deer. Unplanned or unexpected stimuli capture our attention as we engage in complex natural tasks. Research by Jovancevic-Misic and Hayhoe showed that human gaze patterns are sensitive to the probabilistic nature of the environment.⁽²⁸⁾ In this study, participants' eye movement behavior was observed while walking among other pedestrians. The other pedestrians were confederates and were either safe, risky, or rogue pedestrians. When the study began, the risky pedestrian took a collision course with the participant 50 percent of the time, and the rogue pedestrian always assumed a collision course as he approached the participant, whereas the safe pedestrian never took a collision course. Midway through the study the rogue and safe pedestrians exchanged roles but the risky pedestrian role remained the same. The participants were not informed about the behavior of the other pedestrians. Participants were asked to follow a circular path for several laps and to avoid other pedestrians. The study showed that the participants modified their gaze behavior in response to the change in the other pedestrians' behavior. Jovancevic-Misic concluded that participants learned new priorities for gaze allocation within a few encounters and looked both sooner and longer at potentially dangerous pedestrians.⁽²⁸⁾

Gaze behavior in natural environments is affected by expectations that are derived through long-term learning. Using a virtual driving environment, Shinoda et al. asked participants to look for stop signs while driving an urban route.⁽²⁹⁾ Approximately 45 percent of the fixations fell in the general area of intersections during the simulated drive, and participants were more likely to detect stop signs placed near intersections than those placed in the middle of a block. Over time, drivers have learned that stop signs are more likely to appear near intersections and, as a result, drivers prioritize their allocation of gazes to these areas of the roadway.

The Tatler et al. review of the literature concludes that in natural vision, a consistent set of principles underlies eye guidance. These principles include relevance or reward potential, uncertainty about the state of the environment, and learned models of the environment.⁽²¹⁾ Salience of environmental stimuli alone typically does not explain most eye gaze behavior in naturalistic environments.

In sum, most of the literature concerning eye gaze behavior in dynamic environments suggests that task demands tend to override visual salience in determining attention allocation. When extended to driving, it would be expected that visual attention will be directed toward task-relevant areas and objects (e.g., the roadway, other vehicles, speed limit signs, etc.) and other

salient objects, such as billboards, will not necessarily capture attention. However, driving is a somewhat automatic process and conditions generally do not require constant undivided attention. As a result, salient stimuli, such as CEVMS, might capture driver attention and provide an unwarranted increase in driver distraction. The present study addresses this concern.

Research Questions

The present research evaluated the effects of CEVMS on driver visual behavior under actual roadway conditions in the daytime and at night. Roads containing CEVMS, standard billboards, and areas not containing off-premise advertising were selected. The CEVMS and standard billboards were measured with respect to luminance, location, size, and other relevant visual characteristics. The present study examined CEVMS as deployed in two United States cities. Unlike previous studies, the signs did not contain dynamic video or other dynamic elements. In addition, the eye tracking system used in this study has approximately a 2-degree level of resolution. This provided significantly more accuracy in determining what objects the drivers were looking at than in previous on-road studies examining looking behavior (recall that Lee et al. used video recordings of drivers' faces that, at best, examined gross eye movements).⁽⁹⁾

Two studies are reported. Each study was conducted in a different city. The two studies employed the same methodology. The studies' primary research questions were:

1. Do CEVMS attract drivers' attention away from the forward roadway and other driving relevant stimuli?
2. Do glances to CEVMS occur that would suggest a decrease in safety?
3. Do drivers look at CEVMS more than at standard billboards?

EXPERIMENTAL APPROACH

The study used a field research vehicle equipped with a non-intrusive eye tracking system. The vehicle was a 2007 Jeep® Grand Cherokee Sport Utility Vehicle. The eye tracking system used (SmartEye® vehicle-mounted infrared (IR) eye-movement measuring system) is shown in figure 1.⁽³⁰⁾ The system consists of two IR light sources and three face cameras mounted on the dashboard of the vehicle. The cameras and light sources are small in size, and are not attached to the driver in any manner. The face cameras are synchronized to the IR light sources and are used to determine the head position and gaze direction of the driver.



Figure 1. Eye tracking system camera placement.

As a part of this eye tracking system, the vehicle was outfitted with a three-camera panoramic scene monitoring system for capturing the forward driving scene. The scene cameras were mounted on the roof of the vehicle directly above the driver's head position. The three cameras together provided an 80-degree wide by 40-degree high field of forward view. The scene cameras captured the forward view area available to the driver through the left side of the windshield and a portion of the right side of the windshield. The area visible to the driver through the rightmost area of the windshield was not captured by the scene cameras.

The vehicle was also outfitted with equipment to record GPS position, vehicle speed, and vehicle acceleration. The equipment also recorded events entered by an experimenter and synchronized those events with the eye tracking and vehicle data. The research vehicle is pictured in figure 2.



Figure 2. FHWA's field research vehicle.

EXPERIMENTAL DESIGN OVERVIEW

The approach entailed the use of the instrumented vehicle in which drivers navigated routes in cities that presented CEVMS and standard billboards as well as areas without off-premise advertising. The participants were instructed to drive the routes as they normally would. The drivers were not informed that the study was about outdoor advertising, but rather that it was about examining drivers' glance behavior as they followed route guidance directions.

Site Selection

More than 40 cities were evaluated in the selection of the test sites. Locations with CEVMS displays were identified using a variety of resources that included State department of transportation contacts, advertising company Web sites, and a popular geographic information system. A matrix was developed that listed the number of CEVMS in each city. For each site, the number of CEVMS along limited access and arterial roadways was determined.

One criterion for site selection was whether the location had practical routes that pass by a number of CEVMS as well as standard off-premise billboards and could be driven in about 30 minutes. Other considerations included access to vehicle maintenance personnel/facilities, proximity to research facilities, and ease of participant recruitment. Two cities were selected: Reading, and Richmond.

Table 1 presents the 16 cities that were included on the final list of potential study sites.

Table 1. Distribution of CEVMS by roadway classification for various cities.

<i>State</i>	<i>Area</i>	<i>Limited Access</i>	<i>Arterial</i>	<i>Other ⁽¹⁾</i>	<i>Total</i>
VA	Richmond	4	7	0	11
PA	Reading	7	11	0	18
VA	Roanoke	0	11	0	11
PA	Pittsburgh	0	0	15	15
TX	San Antonio	7	2	6	15
WI	Milwaukee	14	2	0	16
AZ	Phoenix	10	6	0	16
MN	St. Paul/Minneapolis	8	5	3	16
TN	Nashville	7	10	0	17
FL	Tampa-St. Petersburg	7	11	0	18
NM	Albuquerque	0	19	1	20
PA	Scranton-Wilkes Barre	7	14	1	22
OH	Columbus	1	22	0	23
GA	Atlanta	13	11	0	24
IL	Chicago	22	2	1	25
CA	Los Angeles	3	71	4	78

(1) Other includes roadways classified as both limited access and arterial or instances where the road classification was unknown. *Source:* www.lamar.com and www.clearchannel.com

In both test cities, the following independent variables were evaluated:

- **The type of advertising.** This included CEVMS, standard billboards, and no off-premise advertising. (It should be noted that in areas with no off-premise advertising, it was still possible to encounter on-premise advertising; e.g., for gas stations, restaurants, and other miscellaneous stores and shops.)
- **Time of day.** This included driving in the daytime and at night.
- **The functional class of roadways in which off-premise advertising signs were located.** Roads were classified as either freeway or arterial. It was observed that the different road classes were correlated with the presence of other visual information that could affect the driver's glance behavior. For example, the visual environment on arterials may be more complex or cluttered than on freeways because of the close proximity of buildings, driveways, and on-premise advertising, etc.

READING

The first on-road study was conducted in Reading. This study examined the type of advertising (CEVMS, standard billboard, or no off-premise advertising), time of day (day or night) and road type (freeway or arterial) as independent variables. Eye tracking was used to assess where participants gazed and for how long while driving. The luminance and contrast of the advertising signs were measured to characterize the billboards in the current study.

METHOD

Selection of Data Collection Zone Limits

Data collection zones (DCZ) were defined on the routes that participants drove where detailed analyses of the eye tracking data were planned. The DCZ were identified that contained a CEVMS, a standard billboard, or no off-premise advertising.

The rationale for selecting the DCZ limits took into account the geometry of the roadway (e.g., road curvature or obstructions that blocked view of billboards) and the capabilities of the eye tracking system (2 degrees of resolution). At a distance of 960 ft (292.61 m), the average billboard in Reading was 12.8 ft (3.90 m) by 36.9 ft (11.25 m) and would subtend a horizontal visual angle of 2.20 degrees and a vertical visual angle of 0.76 degrees, and thus glances to the billboard would just be resolvable by an eye tracking system with 2 degrees of accuracy. Therefore 960 ft was chosen as the maximum distance from billboards at which a DCZ would begin. If the target billboard was not visible from 960 ft (292.61 m) due to roadway geometry or other visual obstructions, such as trees or an overpass, the DCZ was shortened to a distance that prevented these objects from interfering with the driver's vision of the billboard. In DCZs with target off-premise billboards, the end of the DCZ was marked when the target billboard left the view of the scene camera. If the area contained no off-premise advertising, the end of the DCZ was defined by a physical landmark leaving the view of the eye tracking systems' scene camera.

Table 2 shows the data collection zone limits used in this study.

Advertising Conditions

The type of advertising present in DCZs was examined as an independent variable. DCZs fell into one of the following categories, which are listed in the second column of table 2:

- **CEVMS.** These were DCZs that contained one target CEVMS. Two CEVMS DCZs were located on freeways and two were located on arterials. Figure 3 and figure 4 show examples of CEVMS DCZs with the CEVMS highlighted in the pictures.
- **Standard billboard.** These were DCZs that contained one target standard billboard. Two standard billboard DCZs were located on freeways and two were located on arterials. Figure 5 and figure 6 show examples of standard billboard DCZs; the standard billboards are highlighted in the pictures.

- **No off-premise advertising conditions.** These DCZs contained no off-premise advertising. One of these DCZs was on a freeway (see figure 7) and the other was on an arterial (see figure 8).

Table 2. Inventory of target billboards with relevant parameters.

<i>DCZ</i>	<i>Advertising Type</i>	<i>Copy Dimensions (ft)</i>	<i>Side of Road</i>	<i>Setback from Road (ft)</i>	<i>Other Standard Billboards</i>	<i>Approach Length (ft)</i>	<i>Type of Roadway</i>
1	CONTROL	N/A	N/A	N/A	N/A	786	Freeway
6	CONTROL	N/A	N/A	N/A	N/A	308	Arterial
3	CEVMS	10'6" x 22'9"	L	12	0	375	Arterial
5	CEVMS	14'0" x 48'0"	L	133	1	853	Freeway
9	CEVMS	10'6" x 22'9"	R	43	0	537	Arterial
10	CEVMS	14'0" x 48'0"	R	133	1	991	Freeway
2	Standard	14'0" x 48'0"	L	20	0	644	Arterial
7	Standard	14'0" x 48'0"	R	35	1	774	Freeway
8	Standard	10'6" x 22'9"	R	40	1	833	Arterial
4	Standard	14'0" x 48'0"	L	10	0	770	Freeway

**N/A indicates that there were no off-premise advertising in these areas and these values are undefined.*



Figure 3. DCZ with a target CEVMS on a freeway.



Figure 4. DCZ with a target CEVMS on an arterial.

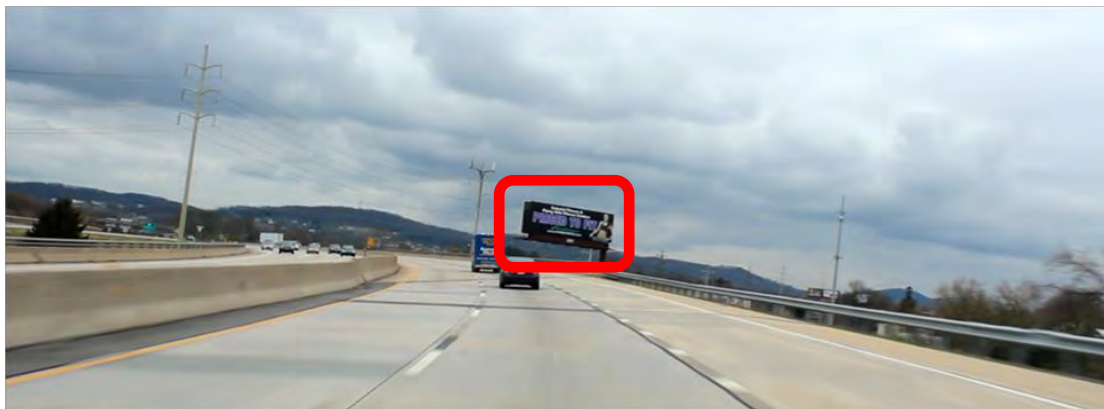


Figure 5. DCZ with a target standard billboard on a freeway.

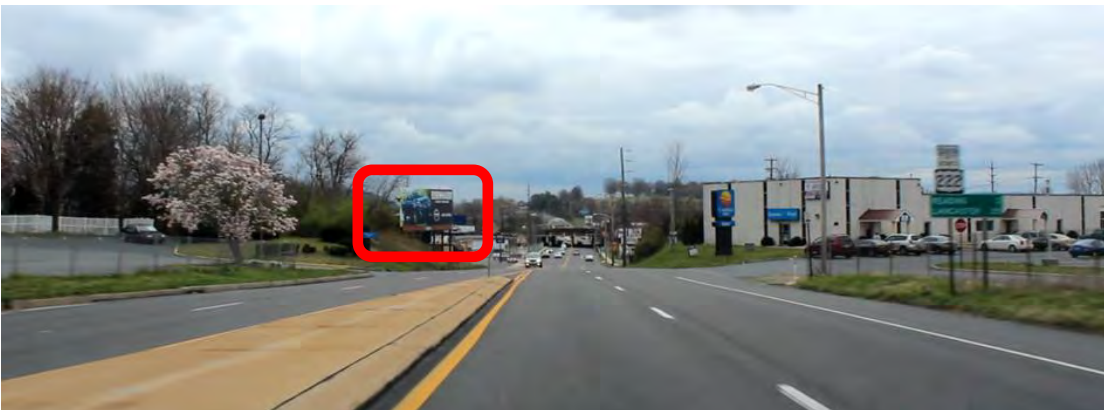


Figure 6. DCZ with a target standard billboard on an arterial.



Figure 7. DCZ for the control condition on a freeway.



Figure 8. DCZ for the control condition on an arterial.

Photometric Measurement of Signs

Two primary metrics were used to describe the photometric characteristics of a sample of the CEVMS and standard billboards present at each location: luminance (cd/m^2) and contrast (Weber contrast ratio).

Photometric Equipment

Luminance was measured with a Radiant Imaging ProMetric 1600 Charge-Coupled Device (CCD) photometer with both a 50 mm and a 300 mm lenses. The CCD photometer provided a method of capturing the luminance of an entire scene at one time.

The photometric sensors were mounted in a vehicle of similar size to the eye tracking research vehicle. The photometer was located in the experimental vehicle as close to the driver's position as possible and was connected to a laptop computer that stored data as the images were acquired.

Measurement Methodology

Images of the billboards were acquired using the photometer manufacturer's software. The software provided the mean luminance of each billboard message. To prevent overexposure of

images in daylight, neutral density filters were manually affixed to the photometer lens and the luminance values were scaled appropriately. Standard billboards were typically measured only once; however, for CEVMS multiple measures were taken to account for changing content.

Photometric measurements were taken during day and night. Measurements were taken by centering the billboard in the photometer's field of view with approximately the equivalent of the width of the billboard on each side and the equivalent of the billboard height above and below the sign. The areas outside of the billboards were included to enable contrast calculations.

Standard billboards were assessed at a mean distance of 284 ft (ranging from 570 ft to 43 ft). The CEVMS were assessed at a mean distance of 479 ft (ranging from 972 ft to 220 ft). To include the background regions of appropriate size, the close measurement distances required the use of the 50 mm lens whereas measurements made from longer distances required the 300 mm lens. A significant determinant of the measurement locations was the availability of accessible and safe places from which to measure.

The Weber contrast ratio was used because it characterizes a billboard as having negative or positive contrast when compared to its background area.⁽³¹⁾ A negative contrast indicates the background areas have a higher mean luminance than the target billboard. A positive contrast indicates the target billboard has a higher mean luminance than the background. Overall, the absolute value of a contrast ratio simply indicates a difference in luminance between an item and its background. From a perceptual perspective luminance and contrast are directly related to the perception of brightness. For example, two signs with equal luminance may be perceived differently with respect to brightness because of differences in contrast.

Visual Complexity

Regan, Young, Lee and Gordon presented a taxonomic description of the various sources of driver distraction.⁽³²⁾ Potential sources of distraction were discussed in terms of: things brought into the vehicle; vehicle systems; vehicle occupants; moving objects or animals in the vehicle; internalized activity; and external objects, events, or activities. The external objects may include buildings, construction zones, billboards, road signs, vehicles, and so on. Focusing on the potential for information outside the vehicle to attract (or distract) the driver's attention, Horberry and Edquist developed a taxonomy for out-of-the-vehicle visual information. This suggested taxonomy includes four groupings of visual information: built roadway, situational entities, natural environment, and built environment.⁽³³⁾ These two taxonomies provide an organizational structure for conducting research; however, they do not currently provide a systematic or quantitative way of classifying the level of clutter or visual complexity present in a visual scene.

The method proposed by Rozenholtz, Li, and Nakano provides quantitative and perhaps reliable measures of visual clutter.⁽³⁴⁾ Their approach measures the feature congestion in a visual image. The implementation of the feature congestion measure involves four stages: (1) compute local feature covariance at multiple scales and compute the volume of the local covariance ellipsoid, (2) combine clutter across scale, (3) combine clutter across feature types, and (4) pool over space to get a single measure of clutter for each input image. The implementation that was used employed color, orientation and luminance contrast as features. Presumably, less cluttered

images can be visually coded more efficiently than cluttered images. For example, visual clutter can cause decreased recognition performance and greater difficulty in performing visual search.⁽³⁵⁾

Participants

In the present study participants were recruited at public libraries in the Reading area. A table was set up so that recruiters could discuss the requirements of the experiment with candidates. Individuals who expressed interest in participating were asked to complete a pre-screening form, a record of informed consent, and a department of motor vehicles form consenting to release of their driving record.

All participants were between 18 and 64 years of age and held a valid driver's license. The driving record for each volunteer was evaluated to eliminate drivers with excessive violations. The criteria for excluding drivers were as follows: (a) more than one violation in the preceding year; (b) more than three recorded violations; and (c) any driving while intoxicated violation.

Forty-three individuals were recruited to participate. Of these, five did not complete the drive because the eye tracker could not be calibrated to track their eye movements accurately. Data from an additional seven participants were excluded as the result of equipment failures (e.g., loose camera). In the end, usable data was collected from 31 participants (12 males, $M = 46$ years; 19 females, $M = 47$ years). Fourteen participants drove at night and 17 drove during the day.

Procedures

Data were collected from two participants per day (beginning at approximately 12:45 p.m. and 7:00 p.m.). Data collection began on September 18, 2009, and was completed on October 26, 2009.

Pre-Data Collection Activities

Participants were greeted by two researchers and asked to complete a fitness to drive questionnaire. This questionnaire focused on drivers' self-reports of alertness and use of substances that might impair driving (e.g., alcohol). All volunteers appeared fit.

Next, the participant and both researchers moved to the eye tracking calibration location and the test vehicle. The calibration procedure took approximately 20 minutes. Calibration of the eye tracking system entailed development of a profile for each participant. This was accomplished by taking multiple photographs of the participant's face as they slowly rotate their head from side to side. The saved photographs include points on the face for subsequent real-time head and eye tracking. Marked coordinates on the face photographs were edited by the experimenter as needed to improve the real-time face tracking. The procedure also included gaze calibration in which participants gazed at nine points on a wall. These points had been carefully plotted on the wall and correspond to the points in the eye tracking system's world model. Gaze calibration relates the individual participant's gaze vectors to known points in the real world. The eye tracking system uses two pulsating infrared sources mounted on the dashboard to create two corneal glints that are used to calculate gaze direction vectors. The glints were captured at 60 Hz. A second set

of cameras (scene cameras), fixed on top of the car close to the driver's viewpoint, were used to produce a video scene of the area ahead. The scene cameras recorded at 25 Hz. A parallax correction algorithm compensated for the distance between the driver's viewpoint and the scene cameras so that later processing could use the gaze vectors to show where in the forward scene the driver was gazing.

If it was not possible to calibrate the eye tracking system to a participant, the participant was dismissed and paid for their time. Causes of calibration failure included reflections from eye glasses, participant height (which put their eyes outside the range of the system), and eyelids that obscure a portion of the pupil.

Practice

After eye-tracker calibration, a short practice drive was made. Participants were shown a map of the route and written turn-by-turn directions prior to beginning the practice drive. Throughout the drive, verbal directions were provided by a GPS device.

During the practice drive, a researcher in the rear seat of the vehicle monitored the accuracy of eye tracking. If the system was tracking poorly, additional calibration was performed. If the calibration could not be improved, the participant was paid for their time and dismissed.

Data Collection

Participants drove two test routes (referred to as route A and B). Each route required 25 to 30 minutes to complete and included both freeway and arterial segments. Route A was 13 miles long and contained 6 DCZs. Route B was 16 miles long and contained 4 DCZs. Combined, participants drove in a total of 10 DCZs. Similar to the practice drive, participants were shown a map of the route and written turn-by-turn directions. A GPS device provided turn-by-turn guidance during the drive. Roughly one half of the participants drove route A first and the remaining participants began with route B. A 5 minute break followed the completion of the first route.

During the drives, a researcher in the front passenger seat assisted the driver when additional route guidance was required. The researcher was also tasked with recording near misses and driver errors if these occurred. The researcher in the rear seat monitored the performance of the eye tracker. If the eye tracker performance became unacceptable (i.e., loss of calibration), then the researcher in the rear asked the participant to park in a safe location so that the eye tracker could be recalibrated. This recalibration typically took a minute or two to accomplish.

Debriefing

After driving both routes, the participants provided comments regarding their drives. The comments were in reference to the use of a navigation system. No questions were asked about billboards. The participants were given \$120.00 in cash for their participation.

DATA REDUCTION

Eye Tracking Measures

The Multiple-Analysis of Psychophysical and Performance Signals (MAPPS™) software was used to reduce the eye tracking data.⁽³⁶⁾ The software integrates the video output from the scene cameras with the output from the eye tracking software (e.g., gaze vectors). The analysis software provides an interface in which the gaze vectors determined by the eye tracker can be related to areas or objects in the scene camera view of the world. Analysts can indicate regions of interest (ROIs) in the scene camera views and the analysis software then assigns gaze vectors to the ROIs.

Figure 9 shows a screen capture from the analysis software in which static ROIs have been identified. These static ROIs slice up the scene camera views into six areas. The software also allows for the construction of dynamic ROIs. These are ROIs that move in the video because of own-vehicle movement (e.g., a sign changes position on the display as it is approached by the driver) or because the object moves over time independent of own-vehicle movement (e.g., pedestrian walking along the road, vehicle entering or exiting the road).

Static ROIs need only be entered once for the scenario being analyzed whereas dynamic ROIs need to be entered several times for a given DCZ depending on how the object moves along the video scene; however, not every frame needs to be coded with a dynamic ROI since the software interpolates across frames using the 60-Hz data to compute eye movement statistics.

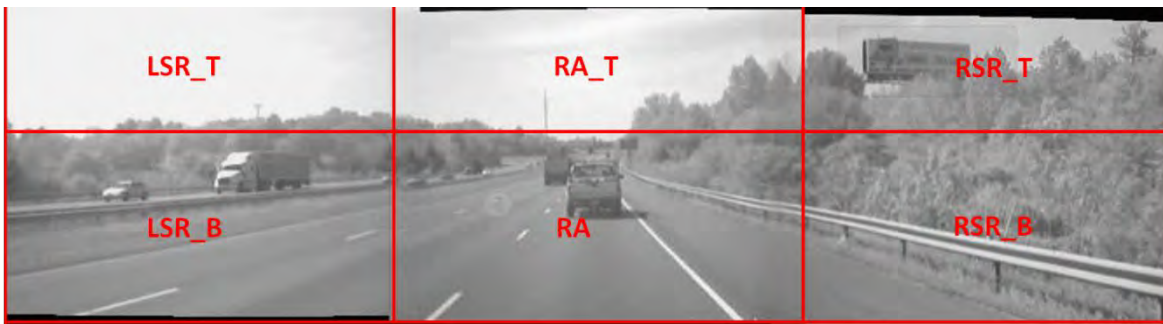


Figure 9. Screen capture showing static ROIs on a scene video output.

The following ROIs were defined with the analysis software:

Static ROIs

These ROIs were entered once into the software for each participant. The static ROIs for the windshield were divided into top and bottom to have more resolution during the coding process. The subsequent analyses in the report combines the top and bottom portion of these ROIs since it appeared that this additional level of resolution was not needed in order to address research questions:

- Road ahead: bottom portion (approximately 2/3) of the area of the forward roadway (center camera).

- Road ahead top: top portion (approximately 1/3) of the area of the forward roadway (center camera).
- Right side of road bottom: bottom portion (approximately 2/3) of the area to the right of the forward roadway (right camera).
- Right side of road top: top portion (approximately 1/3) of the area to the right of the forward roadway (right camera).
- Left side of road bottom (LSR_B): bottom portion (approximately 2/3) of the area to the left of the forward roadway (left camera).
- Left side of road bottom (LSR_T): top portion (approximately 1/3) of the area to the left of the forward roadway (left camera).
- Inside vehicle: below the panoramic video scene (outside of the view of the cameras, but eye tracking is still possible).
- Top: above the panoramic video scene (outside of the view of the cameras, but eye tracking is still possible).

Dynamic ROIs

These ROIs are created multiple times within a DCZ for stimuli that move relative to the driver:

- Driving-related safety risk: vehicle which posed a potential safety risk to the driver, defined as a car that is/may turn into the driver's direction of travel at a non-signalized or non-stop-controlled intersection (e.g., a car making a U-turn, a car waiting to turn right, or a car waiting to turn left). These vehicles were actively turning or entering the roadway or appeared to be in a position to enter the roadway.
- Target standard billboard: target standard billboard that defines the start and end of the DCZ.
- Other standard billboard: standard billboard(s) located in the DCZ, other than the target standard billboard or the target digital billboard.
- CEVMS: target digital billboard that defines the start and end of the DCZ.

The software determines the gaze intersection for each 60 Hz frame and assigns it to an ROI. In subsequent analyses and discussion, gaze intersections are referred to as gazes. Since ROIs may overlap, the software allows for the specification of priority for each ROI such that the ROI with the highest priority gets the gaze vector intersection assigned to it. For example, an ROI for a CEVMS may also be in the static ROI for the road ahead.

The 60 Hz temporal resolution of the eye tracking software does not provide sufficient information to make detailed analysis of saccade characteristics,¹ such as latency or speed. The analysis software uses three parameters in the determination of a fixation: a fixation radius, fixation duration, and a time out. The determination begins with a single-gaze vector intersection. Any subsequent intersection within a specified radius will be considered part of a fixation if the minimum fixation duration criterion is met. The radius parameter used in this study was 2 degrees and the minimum duration was 100 ms. The 2-degree selection was based on the estimated accuracy of the eye tracking system, as recommended by Recarte and Nunes.⁽³⁷⁾ The 100 ms minimum duration is consistent with many other published studies; however, some investigators use minimums of as little as 60 ms.^(37,38) Because of mini-saccades and noise in the eye tracking system, it is possible to have brief excursions outside the 2 degree window for a fixation. In this study, an excursion time outside the 2-degree radius of less than 90 ms was ignored. Once the gaze intersection fell outside the 2-degree radius of a fixation for more than 90 ms, the process of identifying a fixation began anew.

Other Measures

Driving Behavior Measures

During data collection, the front-seat researcher observed the driver's behavior and the driving environment. The researcher used the following subjective categories in observing the participant's driving behavior:

- **Driver Error:** signified any error on behalf of the driver in which the researcher felt slightly uncomfortable, but not to a significant degree (e.g., driving on an exit ramp too quickly, turning too quickly).
- **Near Miss:** signified any event in which the researcher felt uncomfortable due to driver response to external sources (e.g., slamming on brakes, swerving). A near miss is the extreme case of a driver error.
- **Incident:** signified any event in the roadway which may have had a potential impact on the attention of the driver and/or the flow of traffic (e.g., crash, emergency vehicle, animal, construction, train).

These observations were entered into a notebook computer linked to the research vehicle data collection system.

Level of Service Estimates

For each participant and each DCZ the analyst estimated the level of service of the road as they reviewed the scene camera video. One location per DCZ was selected (approximately halfway through the DCZ) where the number of vehicles in front of the research vehicle was counted. The procedure entailed (1) counting the number of travel lanes visible in the video, (2) using the

¹ During visual scanning, the point of gaze alternates between brief pauses (ocular fixations) and rapid shifts (saccades).

skip lines on the road to estimate the approximate distance in front of the vehicle that constituted the analysis zone, and (3) counting the number of vehicles present within the analysis zone. Vehicle density was calculated with the formula:

$$\text{Vehicle Density} = [(\text{Number of Vehicles in Analysis Zone})/(\text{Distance of Analysis Zone in ft}/5280)]/\text{Number of Lanes}.$$

Vehicle density is the number of vehicles per mile per lane.

Vehicle Speed

The speed of the research vehicle was recorded with GPS and a distance measurement instrument. Vehicle speed was used principally to ensure that the eye tracking data was recorded while the vehicle was in motion.

RESULTS

Results are presented with respect to the photometric measures of signs, the visual complexity of the DCZs, and the eye tracking measures. Photometric measurements were taken and analyzed to characterize the billboards in the study based on their luminance and contrasts, which are related to how bright the signs are perceived to be by drivers.

Photometric Measurements

Luminance

The mean daytime luminance of both the standard billboards and CEVMS was greater than at night. Nighttime luminance measurements reflect the fact that CEVMS use illuminating LED components while standard billboards are often illuminated from below by metal halide lamps. At night, CEVMS have a greater average luminance than standard billboards. Table 3 presents summary statistics for luminance as a function of time of day for the CEVMS and standard billboards.

Contrast

The daytime and nighttime Weber contrast ratios for both types of billboards are shown in table 3. Both CEVMS and standard billboards had contrast ratios that were close to zero (the surroundings were about equal in brightness to the signs) during the daytime. On the other hand, at night the CEVMS and standard billboards had positive contrast ratios (the signs were brighter than the surrounding), with the CEVMS having higher contrast than the standard billboards.

Table 3. Summary of luminance (cd/m^2) and contrast (Weber ratio) measurements.

<i>Day</i>	<i>Luminance (cd/m^2)</i>		<i>Contrast</i>	
	<i>Mean</i>	<i>St. Dev.</i>	<i>Mean</i>	<i>St. Dev.</i>
CEVMS	2126	798.81	-0.10	0.54
Standard Billboard	2993	2787.22	-0.27	0.84
<i>Night</i>				
CEVMS	56.00	23.16	73.72	56.92
Standard Billboard	17.80	17.11	36.01	30.93

Visual Complexity

The DCZs were characterized by their overall visual complexity or clutter. For each DCZ, five pictures were taken from the driver's viewpoint at various locations within the DCZ. In Reading, the pictures were taken from 2:00 p.m. to 4:00 p.m. In Richmond, one route was photographed from 11:00 a.m. to noon and the other from 2:30 p.m. to 3:30 p.m. The pictures were taken at the start of the DCZ, quarter of the way through, half of the way through, three quarters of the way through, and at the end of the DCZ. The photographs were analyzed with MATLAB® routines that computed a measure of feature congestion for each image. Figure 10 shows the mean feature congestion measures for each of the DCZ environments. The arterial control condition was shown to have the highest level of clutter as measured by feature congestion. An analysis of variance was performed on the feature congestion measure to determine if the conditions differed significantly from each other. The four conditions with off-premise advertising did not differ significantly with respect to feature congestion; $F(3,36) = 1.25, p > 0.05$. Based on the feature congestion measure, the results indicate that the four conditions with off-premise advertising were equated with respect to the overall visual complexity of the driving scenes.

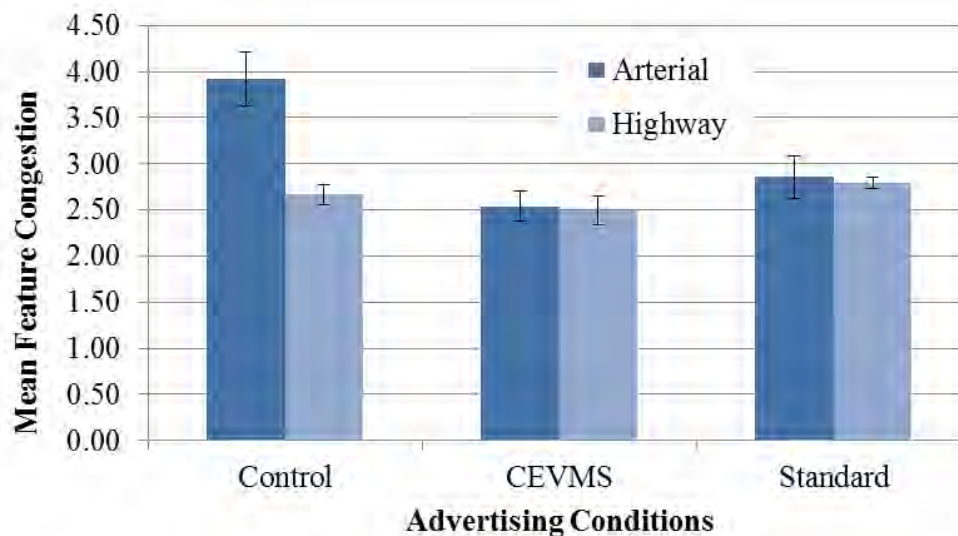


Figure 10. Mean feature congestion as a function of advertising condition and road type (standard errors for the mean are included in the graph).

Effects of Billboards on Gazes to the Road Ahead

For each 60 Hz frame, a determination was made as to the direction of the gaze vector. Previous research has shown that gazes do not need to be separated into saccades and fixations before calculating such measures as percent of time or the probability of looking to the road ahead.⁽³⁹⁾ This analysis examines the degree to which drivers gaze toward the road ahead across the different advertising conditions as a function of road type and time of day. Gazing toward the road ahead is critical for driving, and so the analysis examines the degree to which gazes toward this area are affected by the independent variables (advertising type, type of road, and time of day) and their interactions.

Generalized estimating equations (GEE) were used to analyze the probability of a participant gazing at driving-related information.^(40,41) The data for these analyses were not normally distributed and included repeated measures. The GEE model is appropriate for these types of data and analyses. Note that for all results included in this report, Wald statistics were the chosen alternative to likelihood ratio statistics because GEE uses quasi-likelihood instead of maximum likelihood.⁽⁴²⁾ For this analysis, road ahead included the following ROIs (as previously described and displayed in figure 9): road ahead, road ahead top, and driving-related risks. A logistic regression model for repeated measures was generated by using a binomial response distribution and Logit (i.e., log odds) link function. Only two possible outcomes are allowed when selecting a binomial response distribution. Thus, a variable (RoadAhead) was created to classify a participant's gaze behavior. If the participant gazed toward the road ahead, road ahead top, or driving-related risks, then the value of RoadAhead was set to one. If the participant gazed at any other object in the panoramic scene, then the value of RoadAhead was set to zero. Logistic regression typically models the probability of a success. In the current analysis, a success would be a gaze to road ahead information (RoadAhead = 1) and a failure would be a gaze toward non-road ahead information (RoadAhead = 0). The resultant value was the probability of a participant gazing at road-ahead information.

Time of day (day or night), road type (freeway or arterial), advertising condition (CEVMS, standard billboard, or control), and all corresponding second-order interactions were explanatory variables in the logistic regression model. The interaction of advertising condition by road type was statistically significant, $\chi^2(2) = 6.3, p = 0.043$. Table 4 shows the corresponding probabilities for gazing at the road ahead as a function of advertising condition and road type.

Table 4. The probability of gazing at the road ahead as a function of advertising condition and road type.

<i>Advertising Condition</i>	<i>Arterial</i>	<i>Freeway</i>
Control	0.92	0.86
CEVMS	0.82	0.73
Standard	0.80	0.77

Follow-up analyses for the interaction used Tukey-Kramer adjustments with an alpha level of 0.05. The arterial control condition had the greatest probability of looking at the road ahead ($M = 0.92$). This probability differed significantly from the remaining five probabilities. On

arterials, the probability of gazing at the road ahead did not differ between the CEVMS ($M = 0.82$) and the standard billboard ($M = 0.80$) DCZs. In contrast, there was a significant difference in this probability on freeways, where standard billboard DCZs yielded a higher probability ($M = 0.77$) than CEVMS DCZs ($M = 0.73$). The probability of gazing at the road ahead was also significantly higher in the freeway control DCZ ($M = 0.86$) than in either of the corresponding freeway off-premise advertising DCZs. The probability of gazing at road-ahead information in arterial CEVMS DCZs was not statistically different from the same probability in the freeway control DCZ.

Additional descriptive statistics were computed to determine the probability of gazing at the various ROIs that were defined in the panoramic scene. Some of the ROIs depicted in figure 9 were combined in the following fashion for ease of analysis:

- Road ahead, road ahead top, and driving-related risks combined to form *road ahead*.
- Left side of road bottom and left side of road top combined to form *left side of vehicle*.
- Right side of road bottom and right side of road top combined to form *right side of vehicle*.
- Inside vehicle and top combined to form *participant vehicle*.

Table 5 presents the probability of gazing at the different ROIs.

Table 5. Probability of gazing at ROIs for the three advertising conditions on arterials and freeways.

<i>Road Type</i>	<i>ROI</i>	<i>CEVMS</i>	<i>Standard Billboard</i>	<i>Control</i>
<i>Arterial</i>	<i>CEVMS</i>	0.07	N/A	N/A
	<i>Left Side of Vehicle</i>	0.06	0.06	0.02
	<i>Road ahead</i>	0.82	0.80	0.92
	<i>Right Side of Vehicle</i>	0.03	0.06	0.04
	<i>Standard Billboard</i>	N/A	0.03	N/A
	<i>Participant Vehicle</i>	0.03	0.05	0.02
<i>Freeway</i>	<i>CEVMS</i>	0.05	N/A	N/A
	<i>Left Side of Vehicle</i>	0.08	0.07	0.04
	<i>Road ahead</i>	0.73	0.77	0.86
	<i>Right Side of Vehicle</i>	0.09	0.02	0.05
	<i>Standard Billboard</i>	0.02*	0.09	N/A
	<i>Participant Vehicle</i>	0.04	0.05	0.05

* The CEVMS DCZs on freeways each contained one visible standard billboard.

The probability of gazing away from the forward roadway ranged from 0.08 to 0.27. In particular, the probability of gazing toward a CEVMS was greater on arterials ($M = 0.07$) than on freeways ($M = 0.05$). In contrast, the probability of gazing toward a target standard billboard was greater on freeways ($M = 0.09$) than on arterials ($M = 0.03$).

Fixations to CEVMS and Standard Billboards

About 2.4 percent of the fixations were to CEVMS. The mean fixation duration to a CEVMS was 388 ms and the maximum duration was 1,251 ms. Figure 11 shows the distribution of fixation durations to CEVMS during the day and night. In the daytime, the mean fixation duration to a CEVMS was 389 ms and at night it was 387 ms. Figure 12 shows the distribution of fixation durations to standard billboards. Approximately 2.4 percent of fixations were to standard billboards. The mean fixation duration to standard billboards was 341 ms during the daytime and 370 ms at night. The maximum fixation duration to standard billboards was 1,284 ms (which occurred at night). For comparison purposes, figure 13 shows the distribution of fixation durations to the road ahead (i.e., top and bottom road ahead ROIs) during the day and night. In the daytime, the mean fixation duration to the road ahead was 365 ms and at night it was 390 ms.

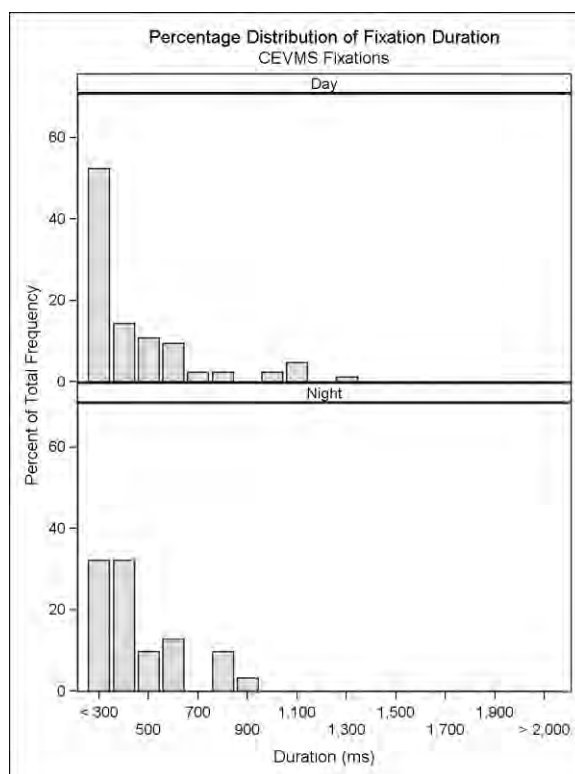


Figure 11. Distribution of fixation duration for CEVMS in the daytime and nighttime.

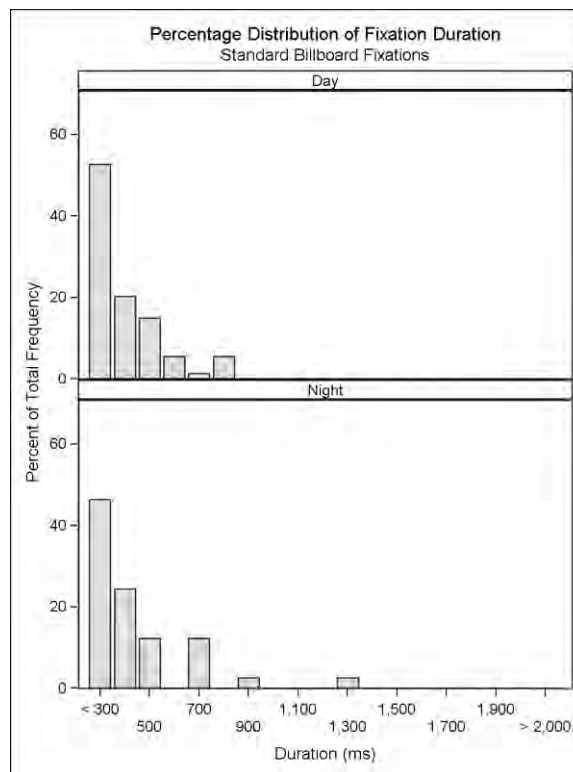


Figure 12. Distribution of fixation duration for standard billboards in the daytime and nighttime.

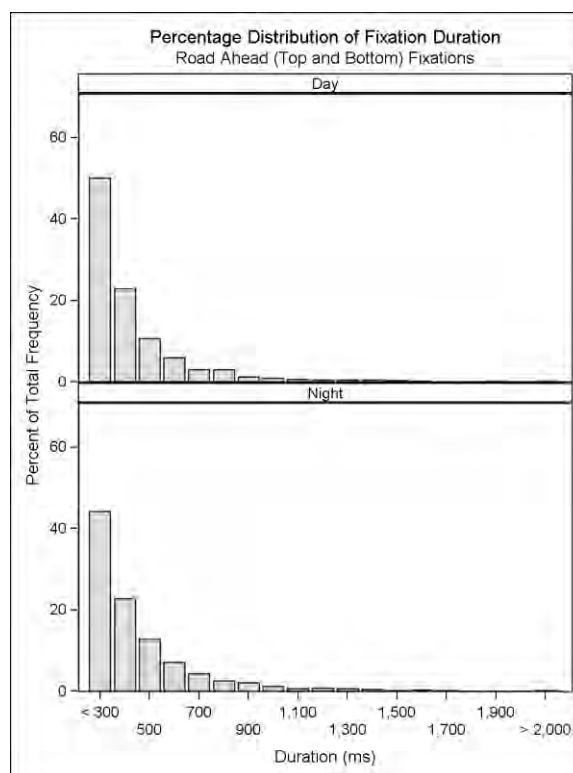


Figure 13. Distribution of fixation duration for road ahead (i.e., top and bottom road ahead ROIs) in the daytime and nighttime.

Dwell times on CEVMS and standard billboards were also examined. Dwell time is the duration of back-to-back fixations to the same ROI.^(43,44) The dwell times represent the cumulative time for the back-to-back fixations. Whereas there may be no long, single fixation to a billboard, there might still be multiple fixations that yield long dwell times. There were a total of 25 separate instances of multiple fixations to CEVMS with a mean of 2.4 fixations (minimum of 2 and maximum of 5). The 25 dwell times came from 15 different participants distributed across four different CEVMS. The mean duration of these dwell times was 994 ms (minimum of 418 ms and maximum of 1,467 ms).

For standard billboards, there were a total of 17 separate dwell times with a mean of 3.47 sequential fixations (minimum of 2 fixations and maximum of 8 fixations). The 17 dwell times came from 11 different participants distributed across 4 different standard billboards. The mean duration of these multiple fixations was 1,172 ms (minimum of 418 ms and maximum of 3,319 ms). There were three dwell-time durations that were greater than 2,000 ms. These are described in more detail below.

In some cases several dwell times came from the same participant. In order to compute a statistic on the difference between dwell times for CEVMS and standard billboards, average dwell times were computed per participant for the CEVMS and standard billboard conditions. These average values were used in a t-test assuming unequal variances. The difference in average dwell time between CEVMS ($M = 981$ ms) and standard billboards ($M = 1,386$ ms) was not statistically significant, $t(12) = -1.40$, $p > .05$.

Figure 14 through figure 23 show heat maps for the dwell-time durations to the standard billboards that were greater than 2,000 ms. These heat maps are snapshots from the DCZ and attempt to convey in two dimensions the pattern of gazes that took place in a three dimensional world. The heat maps are set to look back approximately one to two seconds and integrate over time where the participant was gazing in the scene camera video. The green color in the heat map indicates the concentration of gaze over the past one to two seconds. The blue line indicates the gaze trail over the past one to two seconds.

Figure 14 through figure 16 are for a DCZ on an arterial at night. The standard billboard was on the right side of the road (indicated by a pink rectangle). There were eight fixations to this billboard, and the single fixations were between 200 to 384 ms in duration. The dwell time for this billboard was 2,019 ms. At the start of the DCZ (see figure 14), the driver was directing his/her gaze to the forward roadway. Approaching the standard billboard, the driver began to fixate on the billboard. However, the billboard was still relatively close to the road ahead ROI.

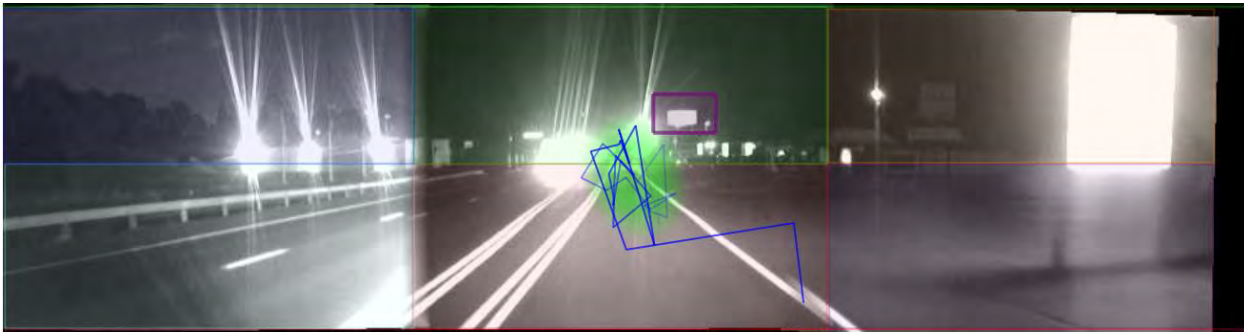


Figure 14. Heat map for the start of a DCZ for a standard billboard at night on an arterial.



Figure 15. Heat map for the middle of a DCZ for a standard billboard at night on an arterial.

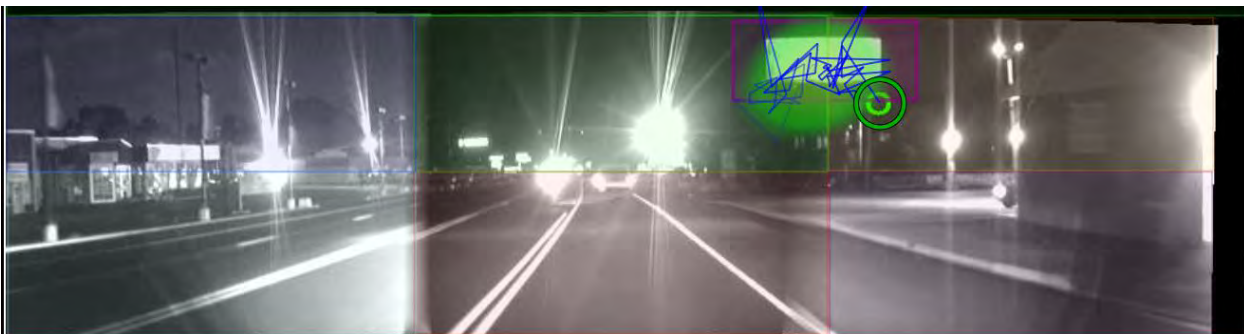


Figure 16. Heat map near the end of a DCZ for a standard billboard at night on an arterial.

Figure 17 through figure 19 are for a DCZ on a freeway at night. The standard billboard was on the right side of the road (indicated by a green rectangle). There were six consecutive fixations to this billboard, and the single fixations were between 200 and 801 ms in duration. The dwell time for this billboard was 2,753 ms. At the start of the DCZ (see figure 17), the driver was directing his/her gaze to a freeway guide sign in the road ahead and the standard billboard was to the left of the freeway guide sign. As the driver approached the standard billboard, his/her gaze was directed toward the billboard. The billboard was relatively close to the top and bottom road ahead ROIs. Near the end of the DCZ (see figure 19), the billboard was accurately portrayed as being on the right side of the road.



Figure 17. Heat map for start of a DCZ for a standard billboard at night on a freeway.

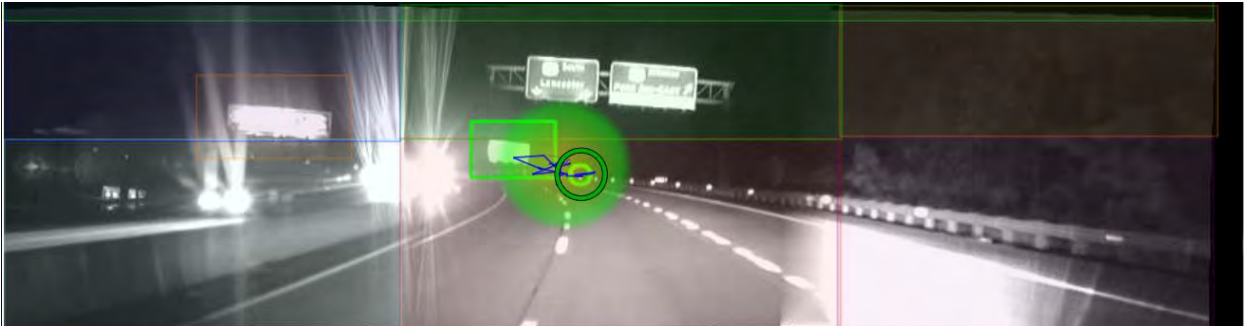


Figure 18. Heat map for middle of a DCZ for a standard billboard at night on a freeway.

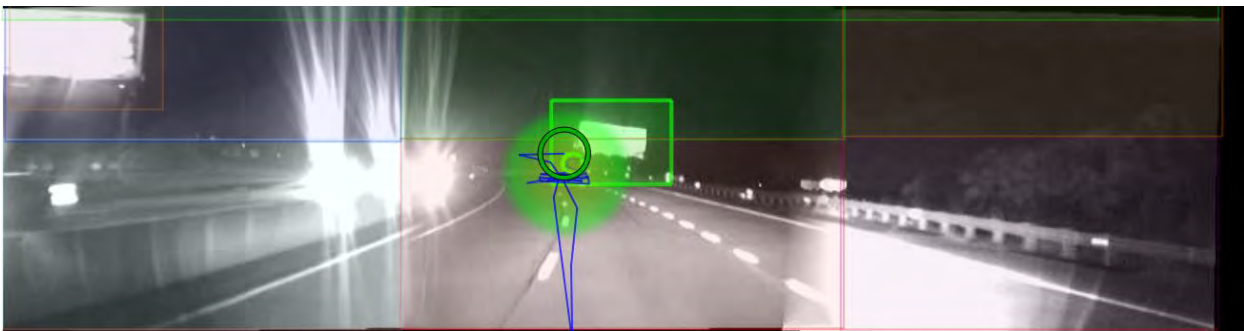


Figure 19. Heat map near the end of a DCZ for a standard billboard at night on a freeway.

Figure 20 through figure 23 are for a DCZ on a freeway during the day. The standard billboard was on the right side of the road (indicated by a pink rectangle). This is the same DCZ that was discussed in figure 17 through figure 19. There were six consecutive fixations to this billboard, and the single fixations were between 217 and 767 ms in duration. The dwell time for this billboard was 3,319 ms. At the start of the DCZ (see figure 20), the driver was principally directing his/her gaze to the road ahead. Figure 21 and figure 22 show the location along the DCZ where gaze was directed toward the standard billboard. The billboard was relatively close to the top and bottom road-ahead ROIs. As the driver passed the standard billboard, his/her gaze returned to the road ahead (see figure 23).

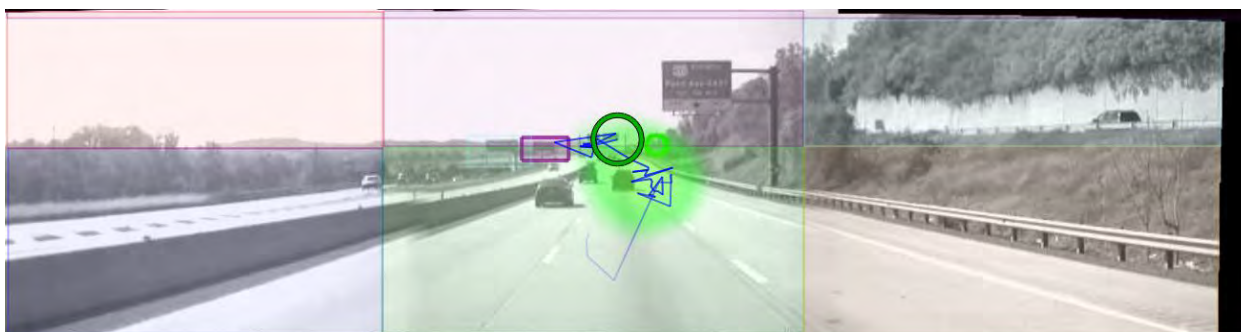


Figure 20. Heat map for the start of a DCZ for a standard billboard in the daytime on a freeway.



Figure 21. Heat map near the middle of a DCZ for a standard billboard in the daytime on a freeway.

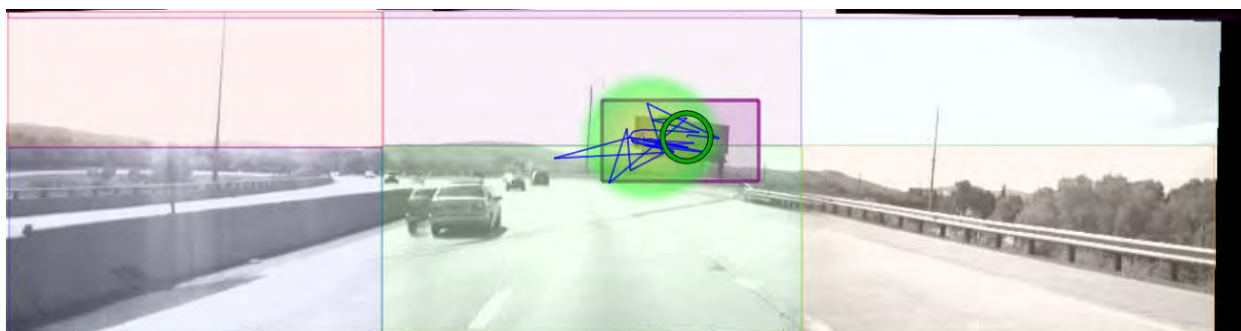


Figure 22. Heat map near the end of DCZ for standard billboard in the daytime on a freeway.

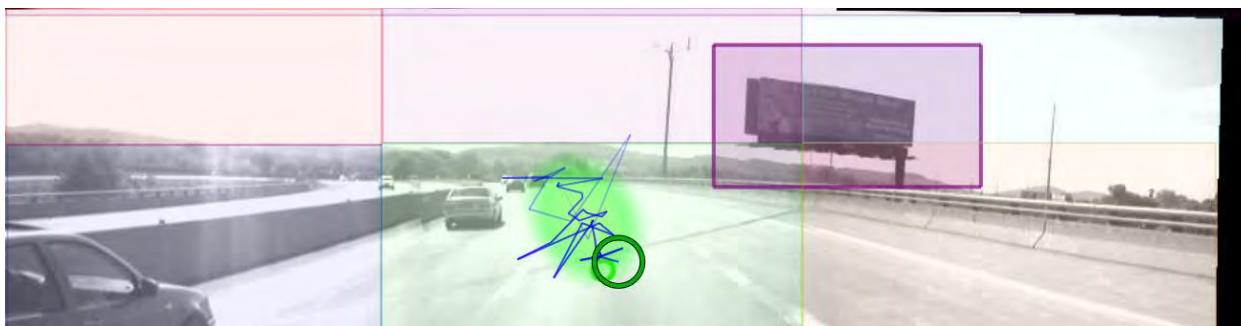


Figure 23. Heat map at the end of DCZ for standard billboard in the daytime on a freeway.

Comparison of Gazes to CEVMS and Standard Billboards

The GEE were used to analyze whether a participant gazed more toward CEVMS than toward standard billboards, given that the participant was gazing at off-premise advertising. With this analysis method, a logistic regression model for repeated measures was generated by using a binomial response distribution and Logit link function. First, the data was partitioned to include only those instances when a participant was gazing toward off-premise advertising (either to a CEVMS or to a standard billboard); all other gaze behavior was excluded from the input data set. Only two possible outcomes are allowed when selecting a binomial response distribution. Thus, a variable (SBB_CEVMS) was created to classify a participant's gaze behavior. If the participant gazed toward a CEVMS, the value of SBB_CEVMS was set to one. If the participant gazed toward a standard billboard, then the value of SBB_CEVMS was set to zero.

Logistic regression typically models the probability of a success. In the current analysis, a success would be a gaze to a CEVMS (SBB_CEVMS = 1) and a failure would be a gaze to a standard billboard (SBB_CEVMS = 0).² A success probability greater than 0.5 indicates there were more successes than failures in the sample. Therefore, if the sample probability of the response variable (i.e., SBB_CEVMS) was greater than 0.5, this would show that participants gazed more toward CEVMS than toward standard billboards when the participants gazed at off-premise advertising. In contrast, if the sample probability of the response variable was less than 0.5, then participants showed a preference to gaze more toward standard billboards than toward CEVMS when directing gazes to off-premise advertising.

Time of day (i.e., day or night), road type (i.e., freeway or arterial), and the corresponding interaction were explanatory variables in the logistic regression model. Road type was the only predictor to have a significant effect, $\chi^2(1) = 13.17, p < 0.001$. On arterials, participants gazed more toward CEVMS than toward standard billboards ($M = 0.63$). In contrast, participants gazed more toward standard billboards than toward CEVMS when driving on freeways ($M = 0.33$).

Observation of Driver Behavior

No near misses or driver errors were observed in Reading.

Level of Service

The mean vehicle densities were converted to level of service as shown in table 6.⁽⁴⁵⁾ As expected, less congestion occurred at night than in the day. In general, there was traffic during the data collection runs. Review of the scene camera data verified that all eye tracking data within the DCZs were recorded while the vehicle was in motion.

² Success and failure are not used to reflect the merits of either type of sign, but only for statistical purposes.

Table 6. Level of service as a function of advertising type, road type, and time of day.

	<i>Arterial</i>		<i>Freeway</i>	
	Day	Night	Day	Night
Control	B	A	C	B
CEVMS	C	A	B	A
Standard	A	A	B	A

DISCUSSION OF READING RESULTS

Overall the probability of gazing at the road ahead was high and similar in magnitude to what has been found in other field studies addressing billboards.^(11,9,12) For the DCZs on freeways, CEVMS showed a lower proportion of gazes to the road ahead than the standard billboard condition, and both off-premise advertising conditions had lower probability of gazes to the road ahead than the control. On the other hand, on the arterials, the CEVMS and standard billboard conditions did not differ from each other but were significantly different from their respective control condition. Though the CEVMS condition on the freeway had the lowest proportion of gazes to the road ahead, in this condition there was a lower proportion of gazes to CEVMS as compared to the arterials (see table 5 for the trade-off of gazes to the different ROIs). A greater proportion of gazes to other ROIs (left side of the road, right side of the road, and participant vehicle) contributed to the decrease in proportion of gazes to the road ahead. Also, for the CEVMS on freeways, there were a few gazes to a standard billboard located in the same DCZ and there were more gazes distributed to the left and right side of the road than in standard billboard and control conditions. The gazes to ROIs other than CEVMS contributed to the lower probability of gazes to the road ahead in this condition.

The control condition on the arterial had buildings along the sides of the road and generally presented a visually cluttered area. As was presented earlier, the feature congestion measure computed on a series of photographs from each DCZ showed a significantly higher feature congestion score for the control condition on arterials as compared to all of the other DCZs. Nevertheless, the highest probability for gazing at the road ahead was seen in the control condition on the arterial.

The area with the highest feature congestion, especially on the sides of the road, had the highest probability for drivers looking at the road ahead. Bottom-up or stimulus driven measures of salience or visual clutter have been useful in predicting visual search and the effects of visual salience in laboratory tasks.^(34,46) These measures of salience basically consider the stimulus characteristics (e.g., size, color, brightness) independent of the requirements of the task or plans that an individual may have. Models of visual salience may predict that buildings and other prominent features on the side of the road may be visually salient objects and thus would attract a driver's attention.⁽⁴⁷⁾ Figure 24 shows an example of a roadway photograph that was analyzed with the Saliency Toolbox based on the Itti et al. implementation of a saliency based model of bottom-up attention.^(48,49) The numbered circles in figure 24 are the first through fifth salient areas selected by the software. Based on this software, the most salient areas in the photographs are the buildings on the sides of the road where the road ahead (and a car) is the fifth selected salient area.

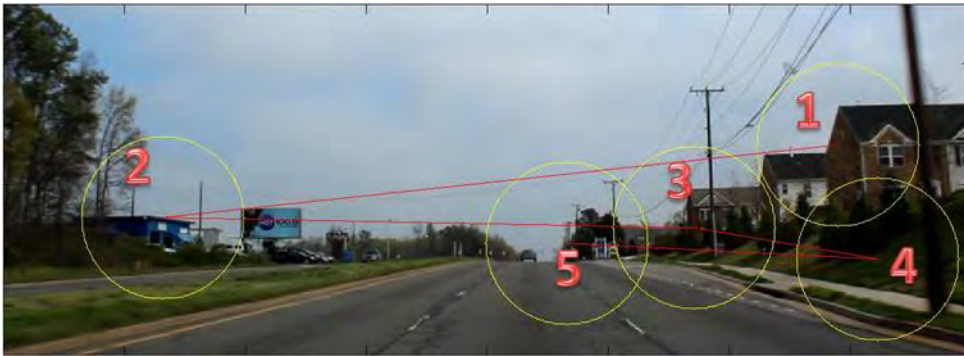


Figure 24. Example of identified salient areas in a road scene based on bottom-up analysis.

It appears that in the present study participants principally kept their eyes on the road even in the presence of visual clutter on the sides of the road, which supports the hypothesis that drivers tend to look toward information relevant to the task at hand.^(50,26,22) In the case of the driving task, visual clutter may be more of an issue with respect to crowding that may affect the driver's ability to detect visual information in the periphery.⁽⁵¹⁾ Crowding is generally defined as the negative effect of nearby objects or features on visual discrimination of a target.⁽⁵²⁾ Crowding impairs the ability to recognize objects in clutter and principally affects perception in peripheral vision. However, crowding effects were not analyzed in the present study.

Stimulus salience, clutter, and the nature of the task at hand interact in visual perception. For tasks such as driving, the task demands tend to outweigh stimulus salience when it comes to gaze control. Clutter may be more of an issue with the detection and recognition of objects in peripheral vision (e.g., detecting a sign on the side of the road) that are surrounded by other stimuli that result in a crowding effect.

The mean fixation durations to CEVMS, standard billboards, and the road ahead were found to be very similar. Also, there were no long fixations (greater than 2,000 ms) to CEVMS or standard billboards. The examination of multiple sequential fixations to CEVMS yielded average dwell times that were less than 1,000 ms. However, when examining the tails of the distribution, there were three dwell times to standard billboards that were in excess of 2,000 ms (the three dwell times came from three different participants to two different billboards). These three standard billboards were dwelled upon when they were near the road ahead area but drivers quit gazing at the signs as they neared them and the signs were no longer near the forward field of view. Though there were three dwell times for standard billboards greater than 2,000 ms, the difference in average dwell times for CEVMS and standard billboards was not significant.

Using a gaze duration of 2,000 ms away from the road ahead as a criterion indicative of increased risk has been developed principally as it relates to looking inside the vehicle to in-vehicle information systems and other devices (e.g., for texting) where the driver is indeed looking completely away from the road ahead.^(14,53,54) The fixations to the standard billboards in the present case showed a long dwell time for a billboard. However, unlike gazing or fixating inside the vehicle, the driver's gaze was within the forward roadway where peripheral vision could be used to monitor for hazards and for vehicle control. Peripheral vision has been shown to be important for lane keeping, visual search orienting, and monitoring of surrounding objects.^(55,56)

The results showed that drivers were more likely to gaze at CEVMS on arterials and at standard billboards on freeways. Though every attempt was made to select CEVMS and standard billboard DCZs that were equated on important parameters (e.g., which side of the road the sign was located on, type of road, level of visual clutter), the CEVMS DCZs on freeways had a greater setback from the road (133 ft for both CEVMS) than the standard billboards (10 and 35 ft). Signs with greater setback from the road would in a sense move out of the forward view (road ahead) more quickly than signs that are closer to the road. The CEVMS and standard billboards on the arterials were more closely matched with respect to setback from the road (12 and 43 ft for CEVMS and 20 and 40 ft for standard billboards).

The differences in setback from the road for CEVMS and standard billboards may also account for differences in dwell times to these two types of billboards. However, on arterials where the CEVMS and standard billboards were more closely matched there was only one long dwell time (greater than 2,000 ms) and it was to a standard billboard at night.

RICHMOND

The objectives of the second study were the same as those in the first study, and the design of the Richmond data collection effort was very similar to that employed in Reading. This study was conducted to replicate as closely as possible the design of Reading in a different driving environment. The independent variables included the type of DCZ (CEVMS, standard billboard, or no off-premise advertising), time of day (day or night) and road type (freeway or arterial). As with Reading, the time of day was a between-subjects variable and the other variables were within subjects.

METHOD

Selection of DCZ Limits

Selection of the DCZ limits procedure was the same as that employed in Reading.

Advertising Type

Three DCZ types (similar to those used in Reading) were used in Richmond:

- **CEVMS.** DCZs contained one target CEVMS.
- **Standard billboard.** DCZs contained one target standard billboard.
- **Control conditions.** DCZs did not contain any off-premise advertising.

There were an equal number of CEVMS and standard billboard DCZs on freeways and arterials. Also, there two DCZ that did not contain off-premise advertising with one located on a freeway and the other on an arterial.

Table 7 is an inventory of the target employed in this second study.

Table 7. Inventory of target billboards in Richmond with relevant parameters.

<i>DCZ</i>	<i>Advertising Type</i>	<i>Copy Dimensions (ft)</i>	<i>Side of Road</i>	<i>Setback from Road (ft)</i>	<i>Other Standard Billboards</i>	<i>Approach Length (ft)</i>	<i>Roadway Type</i>
5	CONTROL	N/A	N/A	N/A	N/A	710	Arterial
3	CONTROL	N/A	N/A	N/A	N/A	845	Freeway
9	CEVMS	14'0" x 28'0"	L	37	0	696	Arterial
13	CEVMS	14'0" x 28'0"	R	37	0	602	Arterial
2	CEVMS	12'5" x 40'0"	R	91	0	297	Freeway
8	CEVMS	11'0 x 23'0"	L	71	0	321	Freeway
10	Standard	14'0" x 48'0"	L	79	1	857	Arterial
12	Standard	10'6" x 45'3"	R	79	2	651	Arterial
1	Standard	14'0" x 48'0"	L	87	0	997	Freeway
7	Standard	14'0" x 48'0"	R	88	0	816	Freeway

* N/A indicates that there were no off-premise advertising in these areas and these values are undefined.

Figure 25 through figure 30 below represent various pairings of DCZ type and road type. Target off-premise billboards are indicated by red rectangles.



Figure 25. Example of a CEVMS DCZ on a freeway.

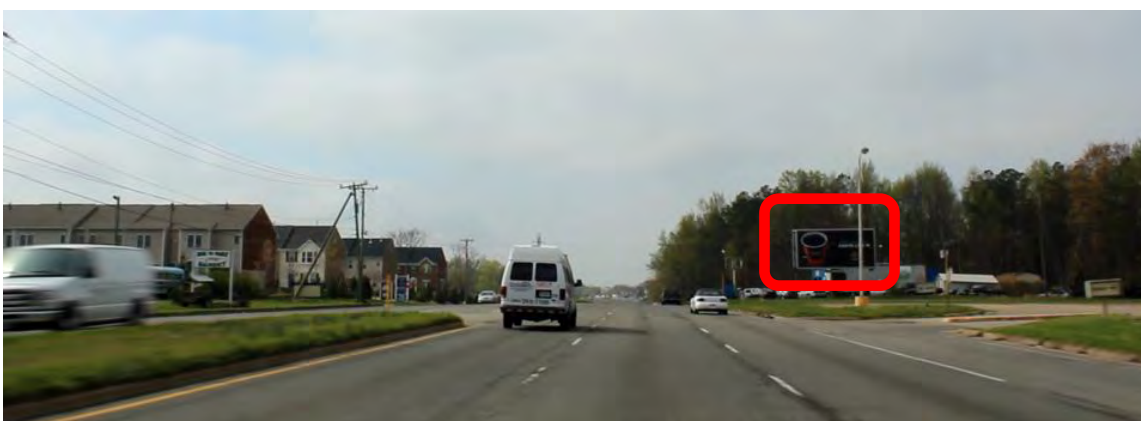


Figure 26. Example of CEVMS DCZ an arterial.

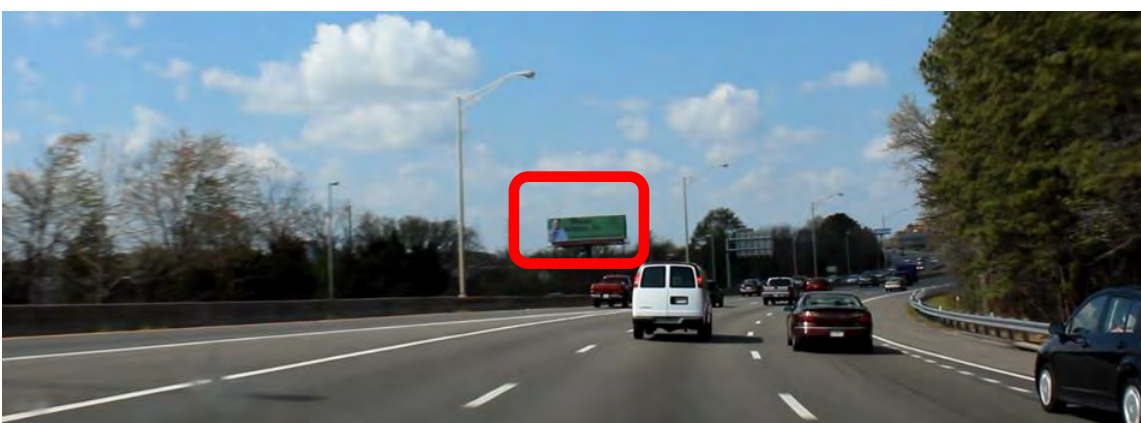


Figure 27. Example of a standard billboard DCZ on a freeway.

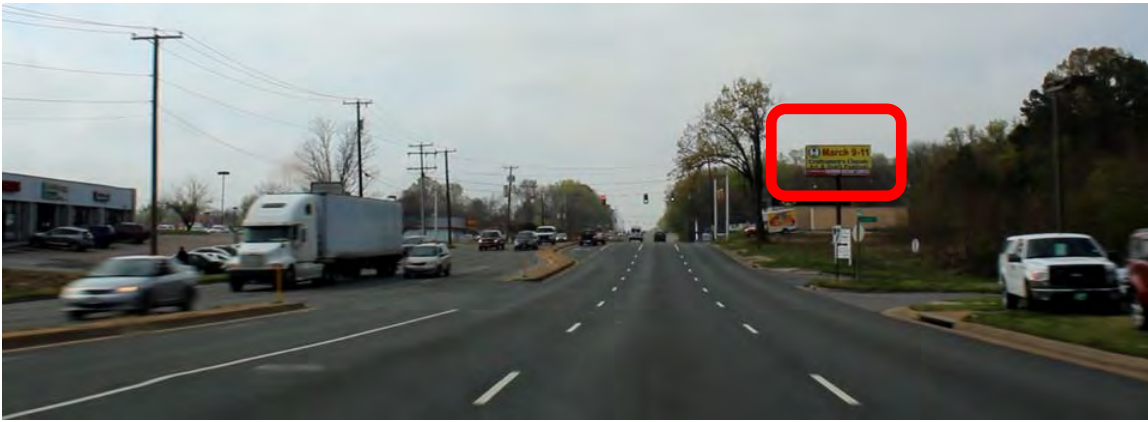


Figure 28. Example of a standard billboard DCZ on an arterial.

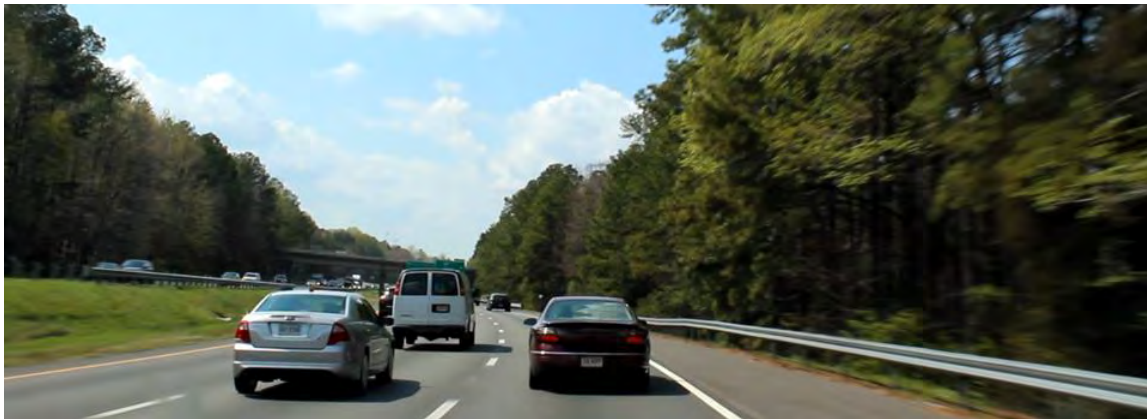


Figure 29. Example of a control DCZ on a freeway.

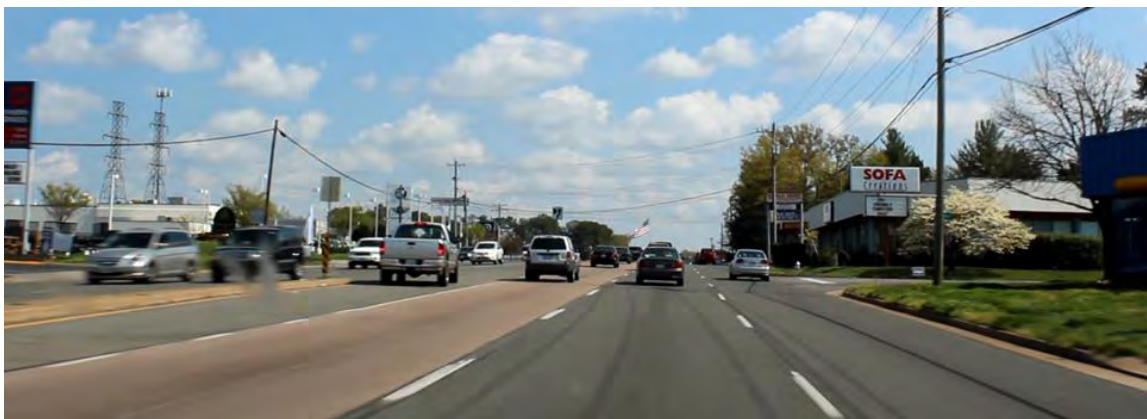


Figure 30. Example of a control DCZ on an arterial.

Photometric Measurement of Signs

The methods and procedures for the photometric measures were the same as for Reading.

Visual Complexity

The methods and procedures for visual complexity measurement were the same as for Reading.

Participants

A total of 41 participants were recruited for the study. Of these, 6 participants did not complete data collection because of an inability to properly calibrate with the eye tracking system, and 11 were excluded because of equipment failures. A total of 24 participants (13 male, $M = 28$ years; 11 female, $M = 25$ years) successfully completed the drive. Fourteen people participated during the day and 10 participated at night.

Procedures

Research participants were recruited locally by means of visits to public libraries, student unions, community centers, etc. A large number of the participants were recruited from a nearby university, resulting in a lower mean participant age than in Reading.

Participant Testing

Two people participated each day. One person participated during the day beginning at approximately 12:45 p.m. The second participated at night beginning at around 7:00 p.m. Data collection ran from November 20, 2009, through April 23, 2010. There were several long gaps in the data collection schedule due to holidays and inclement weather.

Pre-Data Collection Activities

This was the same as in Reading.

Practice Drive

Except for location, this was the same as in Reading.

Data Collection

The procedure was much the same as in Reading. On average, each test route required approximately 30 to 35 minutes to complete. As in Reading, the routes included a variety of freeway and arterial driving segments. One route was 15 miles long and contained two target CEVMS, two target standard billboards, and two DCZs with no off-premise advertising. The second route was 20 miles long and had two target CEVMS and two target standard billboards.

The data collection drives in this second study were longer than those in Reading. The eye tracking system had problems dealing with the large files that resulted. To mitigate this technical difficulty, participants were asked to pull over in a safe location during the middle of each data collection drive so that new data files could be initiated.

Upon completion of the data collection, the participant was instructed to return to the designated meeting location for debriefing.

Debriefing

This was the same as in Reading.

DATA REDUCTION

Eye Tracking Measures

The approach and procedures were the same as used in Reading.

Other Measures

The approach and procedures were the same as used in Reading.

RESULTS

Photometric Measurement of Signs

The photometric measurements were performed using the same equipment and procedures that were employed in Reading with a few minor changes. Photometric measurements were taken during the day and at night. Measurements of the standard billboards were taken at an average distance of 284 ft, with maximum and minimum distances of 570 ft and 43 ft, respectively. The average distance of measurements for the CEVMS was 479 ft, with maximum and minimum distances of 972 ft and 220 ft, respectively. Again, the distances employed were significantly affected by the requirement to find a safe location on the road from which to take the measurements.

Luminance

The mean luminance of CEVMS and standard billboards, during daytime and nighttime are shown below in table 8. The results here are similar to those for Reading.

Contrast

The daytime and nighttime Weber contrast ratios for both types of billboards are shown in table 8. During the day, the contrast ratios of both CEVMS and standard billboards were close to zero (the surroundings were about equal in brightness to the signs). At night, the CEVMS and standard billboards had positive contrast ratios. Similar to Reading, the CEVMS showed a higher contrast ratio than the standard billboards at night.

Table 8. Summary of luminance (cd/m^2) and contrast (Weber ratio) measurements.

	<i>Luminance (cd/m^2)</i>		<i>Contrast</i>	
	Mean	St. Dev.	Mean	St. Dev.
<i>Day</i>				
CEVMS	2134	798.70	-0.20	0.53
Standard Billboard	3063	2730.92	0.03	0.32
<i>Night</i>				
CEVMS	56.44	16.61	69.70	59.18
Standard Billboard	8.00	5.10	6.56	3.99

Visual Complexity

As with Reading, the feature congestion measure was used to estimate the level of visual complexity/clutter in the DCZs. The analysis procedures were the same as for Reading.

Figure 31 shows the mean feature congestion measures for each of the advertising types (standard errors are included in the figure). Unlike the results for Reading, the selected off-premise advertising DCZs for Richmond differed in terms of mean feature congestion; $F(3, 36) = 3.95, p = 0.016$. Follow up t-tests with an alpha of 0.05 showed that the CEVMS DCZs on arterials had significantly lower feature congestion than all of the other off-premise advertising conditions. None of the remaining DCZs with off-premise advertising differed from each other. The selection of DCZs for the conditions with off-premise advertising took into account the type of road, the side of the road the target billboard was placed, and the perceived level of visual clutter. Based on the feature congestion measure, these results indicated that the conditions with off-premise advertising were not equated with respect to level of visual clutter.

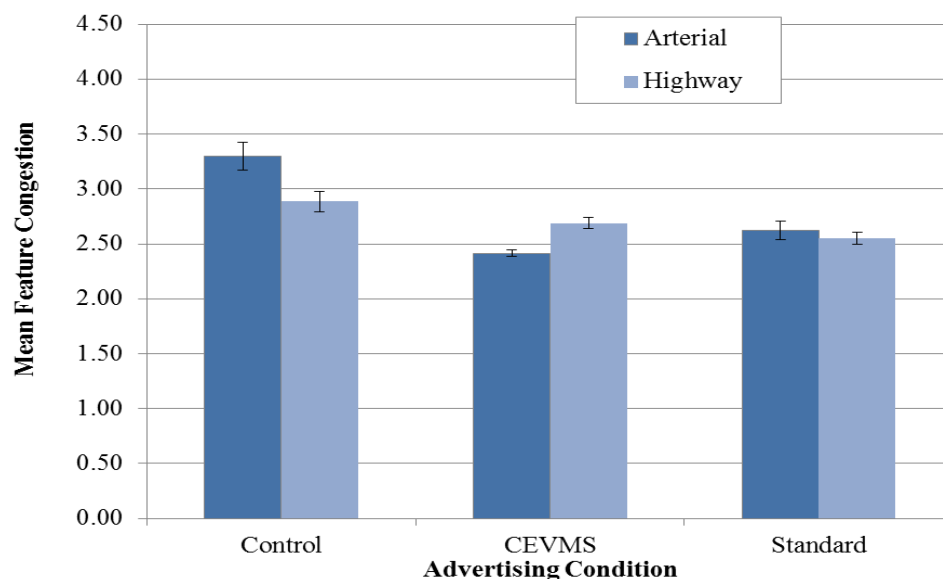


Figure 31. Mean feature congestion as a function of advertising condition and road type.

Effects of Billboards on Gazes to the Road Ahead

As was done for the data from Reading, GEE were used to analyze the probability of a participant gazing at the road ahead. A logistic regression model for repeated measures was generated by using a binomial response distribution and Logit link function. The resultant value was the probability of a participant gazing at the road ahead (as previously defined).

Time of day (day or night), road type (freeway or arterial), advertising type (CEVMS, standard billboard, or control), and all corresponding second-order interactions were explanatory variables in the logistic regression model. The interaction of advertising type by road type was statistically significant, $\chi^2(2) = 14.19, p < 0.001$. Table 9 shows the corresponding probability of gazing at the road ahead as a function of advertising condition and road type.

Table 9. The probability of gazing at the road ahead as a function of advertising condition and road type.

<i>Advertising Condition</i>	<i>Arterial</i>	<i>Freeway</i>
Control	0.78	0.92
CEVMS	0.76	0.82
Standard	0.81	0.85

Follow-up analyses for the interaction used Tukey-Kramer adjustments with an alpha level of 0.05. The freeway control had the greatest probability of gazing at the road ahead ($M = 0.92$). This probability differed significantly from the remaining five probabilities. On arterials, there were no significant differences among the probabilities of gazing at the road ahead among the three advertising conditions. On freeways, there was no significant difference between the probability associated with CEVMS DCZs and the probability associated with standard billboard DCZs.

Additional descriptive statistics were computed for the three advertising types to determine the probability of gazing at the ROIs that were defined in the panoramic scene. As was done with the data from Reading, some of the ROIs were combined for ease of analysis. Table 10 presents the probability of gazing at the different ROIs.

Table 10. Probability of gazing at ROIs for the three advertising conditions on arterials and freeways.

<i>Road Type</i>	<i>ROI</i>	<i>CEVMS</i>	<i>Standard Billboard</i>	<i>Control</i>
<i>Arterial</i>	<i>CEVMS</i>	0.06	N/A	N/A
	<i>Left Side of Vehicle</i>	0.03	0.05	0.04
	<i>Road ahead</i>	0.76	0.81	0.78
	<i>Right Side of Vehicle</i>	0.07	0.06	0.09
	<i>Standard Billboard</i>	N/A	0.02	N/A
	<i>Participant Vehicle</i>	0.07	0.06	0.09
<i>Freeway</i>	<i>CEVMS</i>	0.05	N/A	N/A
	<i>Left Side of Vehicle</i>	0.03	0.01	0.01
	<i>Road ahead</i>	0.82	0.85	0.92
	<i>Right Side of Vehicle</i>	0.04	0.04	0.03
	<i>Standard Billboard</i>	N/A	0.04	N/A
	<i>Participant Vehicle</i>	0.06	0.06	0.05

The probability of gazing away from the forward roadway ranged from 0.08 to 0.24. In particular, the probability of gazing toward a CEVMS was slightly greater on arterials ($M = 0.06$) than on freeways ($M = 0.05$). In contrast, the probability of gazing toward a standard billboard was greater on freeways ($M = 0.04$) than on arterials ($M = 0.02$). In both situations, the probability of gazing at the road ahead was greatest on freeways.

Fixations to CEVMS and Standard Billboards

About 2.5 percent of the fixations were to CEVMS. The mean fixation duration to a CEVMS was 371 ms and the maximum fixation duration was 1,335 ms. Figure 32 shows the distribution of fixation durations to CEVMS during the day and at night. In the daytime, the mean fixation duration to a CEVMS was 440 ms and at night it was 333 ms. Approximately 1.5 percent of the fixations were to standard billboards. The mean fixation duration to standard billboards was 318 ms and the maximum fixation duration was 801 ms. Figure 33 shows the distribution of fixation durations for standard billboards. The mean fixation duration to a standard billboard was 313 ms and 325 ms during the day and night, respectively. For comparison purposes, figure 34 shows the distribution of fixation durations to the road ahead during the day and night. In the daytime, the mean fixation duration to the road ahead was 378 ms and at night it was 358 ms.

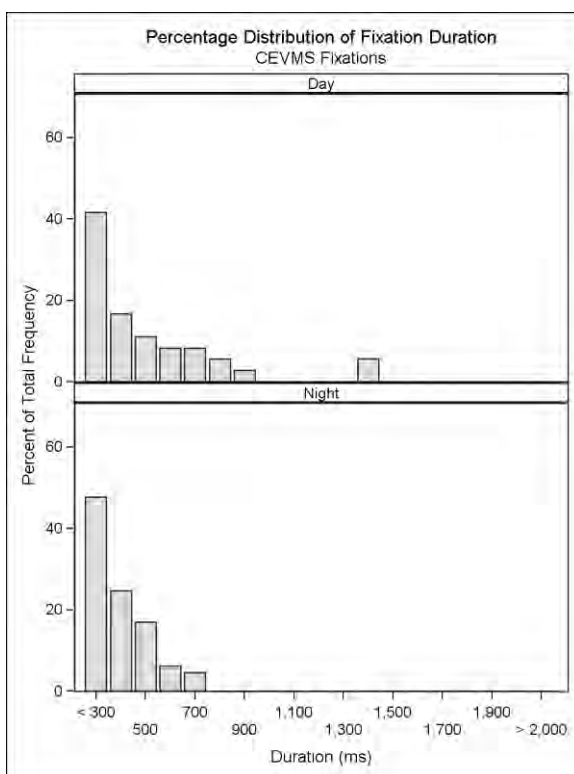


Figure 32. Fixation duration for CEVMS in the day and at night.

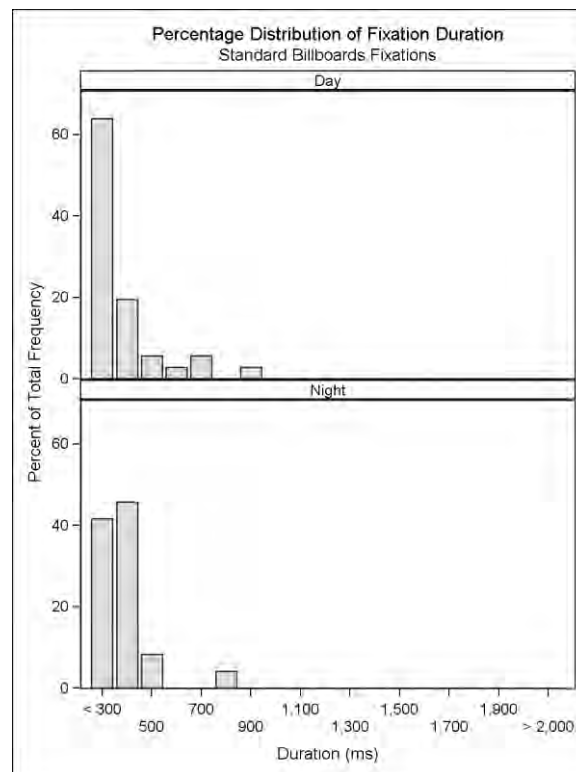


Figure 33. Fixation duration for standard billboards in the day and at night.

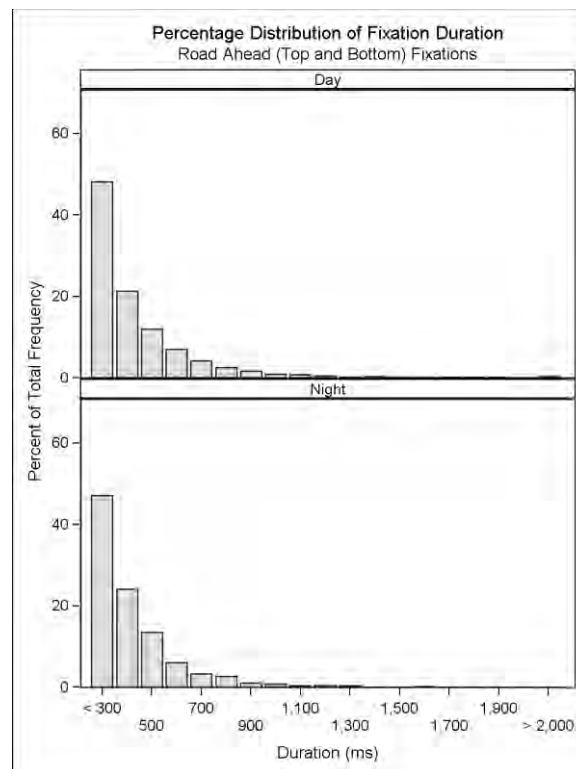


Figure 34. Fixation duration for the road ahead in the day and at night.

As was done with the data for Reading, the record of fixations was examined to determine dwell times to CEVMS and standard billboards. There were a total of 21 separate dwell times to CEVMS with a mean of 2.86 sequential fixations (minimum of 2 fixations and maximum of 6 fixations). The 21 dwell times came from 12 different participants and four different CEVMS. The mean dwell time duration to the CEVMS was 1,039 ms (minimum of 500 ms and maximum of 2,720 ms). There was one dwell time greater than 2,000 ms to CEVMS. To the standard billboards there were 13 separate dwell times with a mean of 2.31 sequential fixations (minimum of 2 fixations and maximum of 3 fixations). The 13 dwell times came from 11 different participants and four different standard billboards. The mean dwell time duration to the standard billboards was 687 ms (minimum of 450 ms and maximum of 1,152 ms). There were no dwell times greater than 2,000 ms to standard billboards.

In some cases several dwell times came from the same participant. To compute a statistic on the difference between dwell times for CEVMS and standard billboards, average dwell times were computed per participant for the CEVMS and standard billboard conditions. These average values were used in a *t*-test assuming unequal variances. The difference in average dwell time between CEVMS ($M = 1,096$ ms) and standard billboards ($M = 674$ ms) was statistically significant, $t(14) = 2.23$, $p = .043$.

Figure 35 through figure 37 show heat maps for the dwell-time durations to the CEVMS that were greater than 2,000 ms. The DCZ was on a freeway during the daytime. The CEVMS is located on the left side of the road (indicated by an orange rectangle). There were three fixations to this billboard, and the single fixations were between 651 ms and 1,335 ms. The dwell time for this billboard was 2,270 ms. Figure 35 shows the first fixation toward the CEVMS. There are no vehicles near the participant in his/her respective travel lane or adjacent lanes. In this situation, the billboard is relatively close to the road ahead ROI. Figure 36 shows a heat map later in the DCZ where the driver continues to look at the CEVMS. The heat map does not overlay the CEVMS in the picture since the heat map has integrated over time where the driver was gazing. The CEVMS has moved out of the area because of the vehicle moving down the road. However, visual inspection of the video and eye tracking statistics showed that the driver was fixating on the CEVMS. Figure 37 shows the end of the sequential fixations to the CEVMS. The driver returns to gaze directly in front of the vehicle. Once the CEVMS was out of the forward field of view, the driver quit looking at the billboard.

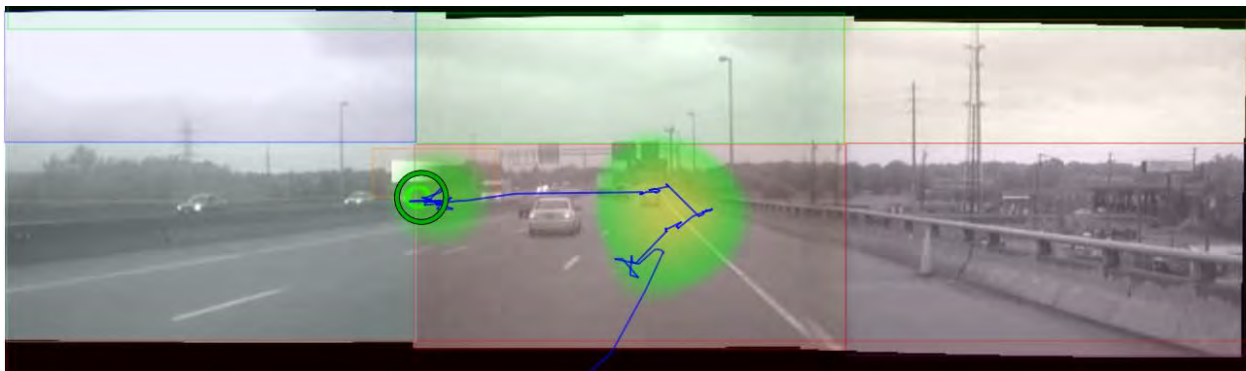


Figure 35. Heat map for first fixation to CEVMS with long dwell time.



Figure 36. Heat map for later fixations to CEVMS with long dwell time.

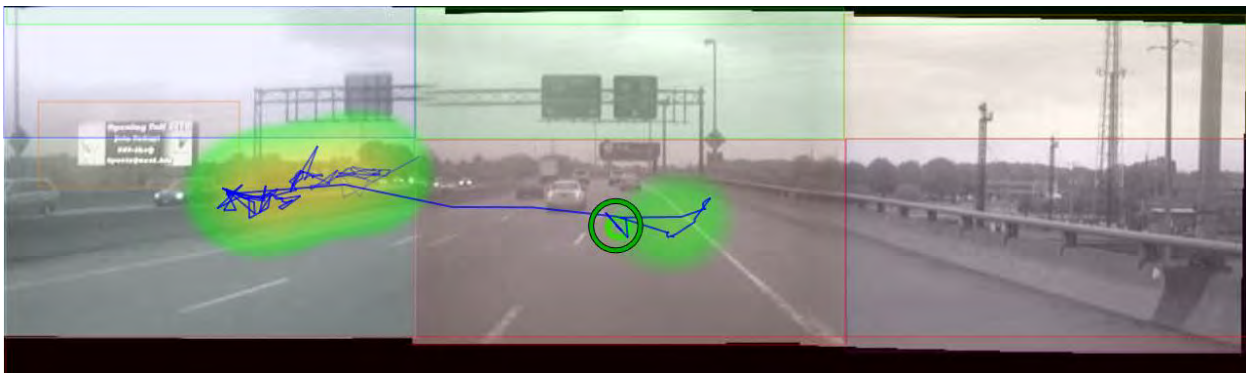


Figure 37. Heat map at end of fixations to CEVMS with long dwell time.

Comparison of Gazes to CEVMS and Standard Billboards

As was done for the data from Reading, GEE were used to analyze whether a participant gazed more toward CEVMS than toward standard billboards, given that the participant was looking at off-premise advertising. Recall that a sample probability greater than 0.5 indicated that participants gazed more toward CEVMS than standard billboards when the participants gazed at off-premise advertising. In contrast, if the sample probability was less than 0.5, participants showed a preference to gaze more toward standard billboards than CEVMS when directing visual attention to off-premise advertising.

Time of day (i.e., day or night), road type (i.e., freeway or arterial), and the corresponding interaction were explanatory variables in the logistic regression model. Time of day had a significant effect on participant gazes toward off-premise advertising, $\chi^2(1) = 4.46, p = 0.035$. Participants showed a preference to gaze more toward CEVMS than toward standard billboards during both times of day. During the day the preference was only slight ($M = 0.52$), but at night the preference was more pronounced ($M = 0.71$). Road type was also a significant predictor of where participants directed their gazes at off-premise advertising, $\chi^2(1) = 3.96, p = 0.047$. Participants gazed more toward CEVMS than toward standard billboards while driving on both types of roadways. However, driving on freeways yielded a slight preference for CEVMS over standard billboards ($M = 0.55$), but driving on arterials resulted in a larger preference in favor of CEVMS ($M = 0.68$).

Observation of Driver Behavior

No near misses or driver errors occurred.

Level of Service

Table 11 shows the level of service as a function of advertising type, type of road, and time of day. As expected, there was less congestion during the nighttime runs than in the daytime. In general, there was traffic during the data collection runs; however, the eye tracking data were recorded while the vehicles were in motion.

Table 11. Estimated level of service as a function of advertising condition, road type, and time of day.

	Arterial		Freeway	
	Day	Night	Day	Night
Control	B	A	C	B
CEVMS	B	A	B	A
Standard	C	A	C	C

DISCUSSION OF RICHMOND RESULTS

Overall the probability of looking at the forward roadway was high across all conditions and consistent with the findings from Reading and previous related research.^(11,9,12) In this second study the CEVMS and standard billboard conditions did not differ from each other. For the DCZs on arterials there were no significant differences among the control, CEVMS, and standard billboard conditions. On the other hand, while the CEVMS and standard billboard conditions on the freeways did not differ from each other, they were significantly different from their respective control conditions. The control condition on the freeway principally had trees along the sides of the road and the signs that were present were freeway signs located in the road ahead ROI.

Measures such as feature congestion rated the three DCZs on freeways as not being statistically different from each other. These types of measures have been useful in predicting visual search and the effects of visual salience in laboratory tasks.⁽³⁴⁾ Models of visual salience may predict that, at least during the daytime, trees on the side of the road may be visually salient objects that would attract a driver's attention.⁽⁴⁷⁾ However, it appears that in the present study, participants principally kept their eyes on the road ahead.

The mean fixations to CEVMS, standard billboards, and the road ahead were found to be similar in magnitude with no long fixations. Examination of dwell times showed that there was one long dwell time for a CEVMS greater than 2,000 ms and it occurred in the daytime on a sign located on the left side of the road on a freeway DCZ. Furthermore, when averaging among participants the mean dwell time for CEVMS was significantly longer than to standard billboards, but still under 2,000 ms. For the dwell time greater than 2,000 ms, examination of the scene camera video and eye tracking heat maps showed that the driver was initially looking toward the forward roadway and made a first fixation to the sign. Three fixations were made to the sign and then the

driver started looking back to the road ahead as the sign moved out of the forward field of view. On the video there were no vehicles near the subject driver's own lane or in adjacent lanes.

Only the central 2 degrees of vision, foveal vision, provide resolution sharp enough for reading or recognizing fine detail.⁽⁵⁷⁾ However, useful information for reading can be extracted from parafoveal vision, which encompasses the central 10 degrees of vision.⁽⁵⁷⁾ More recent research on scene gist recognition³ has shown that peripheral vision (beyond parafoveal vision) is more useful than central vision for recognizing the gist of a scene.⁽⁵⁸⁾ Scene gist recognition is a critically important early stage of scene perception, and influences more complex cognitive processes such as directing attention within a scene and facilitating object recognition, both of which are important in obtaining information while driving.

The results of this study do show one duration of eyes off the forward roadway greater than 2,000 ms, the duration at which Klauer et al. observed near-crash/crash risk at more than twice those of normal, baseline driving.^(14,53) When looking at the tails of the fixation distributions, few fixations were greater than 1,000 ms, with the longest fixation being equal to 1,335 ms.^(53,54) The one long dwell time on a CEVMS that was observed was a rare event in this study, and review of the video and eye tracking data suggests that the driver was effectively managing acquisition of visual information while driving and fixated on the advertising. However, additional work needs to be done to derive criteria for gazing or fixating away from the forward road view where the road scene is still visible in peripheral vision.

The results showed that drivers are more likely to look at CEVMS than standard billboards during the nighttime across the conditions tested (at night the average probability of gazing at CEVMS was $M = 0.71$). CEVMS do have greater luminance than standard billboards at night and also have higher contrast. The CEVMS have the capability of being lit up so that they would appear as very bright signs to drivers (for example, up to about $10,000 \text{ cd/m}^2$ for a white square on the sign.). However, our measurements of these signs showed an average luminance of about 56 cd/m^2 . These signs would be conspicuous in a nighttime driving environment but significantly less so than other light sources such as vehicle headlights. Drivers were also more likely to look at CEVMS than standard billboards on both arterials and freeways, with a higher probability of gazes on arterials.

In this second study, CEVMS and standard billboards were more nearly equated with respect to setback from the road. Gazes to the road ahead were not significantly different between CEVMS and standard billboard DCZs across conditions and the proportion of gazes to the road ahead were consistent with previous research. One long dwell time for a CEVMS was observed in this study; however, it occurred in the daytime where the luminance and contrast (affecting the perceived brightness) of these signs are similar to those for standard billboards.

³ "Scene gist recognition" refers to the element of human cognition that enables us to determine the meaning of a scene and categorize it by type (e.g., a beach, an office) almost immediately upon seeing it.

GENERAL DISCUSSION

This study was conducted to investigate the effect of CEVMS on driver visual behavior in a roadway driving environment. An instrumented vehicle with an eye tracking system was used. Roads containing CEVMS, standard billboards, and control areas with no off-premise advertising were selected. The CEVMS and standard billboards were measured with respect to luminance, location, size, and other relevant variables to characterize these visual stimuli. Unlike previous studies on digital billboards, the present study examined CEVMS as deployed in two United States cities and did not contain dynamic video or other dynamic elements. The CEVMS changed content approximately every 8 to 10 seconds, consistent within the limits provided by FHWA guidance.⁽²⁾ In addition, the eye tracking system used had nearly a 2-degree level of resolution that provided significantly more accuracy in determining what objects the drivers were gazing or fixating on as compared to some previous field studies examining CEVMS.

CONCLUSIONS

Do CEVMS attract drivers' attention away from the forward roadway and other driving relevant stimuli?

Overall, the probability of looking at the road ahead was high across all conditions. In Reading, the CEVMS condition had a lower proportion of gazes to the road ahead than the standard billboard condition on the freeways. Both of the off-premise advertising conditions had a lower proportion of gazes to the road ahead than the control condition on the freeway. The lower proportion of gazes to the road ahead can be attributed to the overall distribution of gazes away from the road ahead and not just to the CEVMS. On the other hand, for the arterials the CEVMS and standard billboard conditions did not differ from each other, but both had a lower proportion of gazes to the road ahead compared to the control. In Richmond there were no differences among the three advertising conditions on the arterials. However, for the freeways the CEVMS and standard billboard conditions did not differ from each other but had a lower proportion of gazes to the road ahead than the control.

The control conditions differed across studies. In Reading, the control condition on arterials showed 92 percent for gazing at the road ahead while on the freeway it was 86 percent. On the other hand, in Richmond the control condition for arterials was 78 percent and for the freeway it was 92 percent. The control conditions on the freeway differed across the two studies. In Reading there were businesses off to the side of the road; whereas in Richmond the sides of the road were mostly covered with trees. The control conditions on the arterials also differed across cities in that both contained businesses and on-premise advertising; however, in Reading arterials had four lanes and in Richmond arterials had six lanes. The reason for these differences across cities was that these control conditions were selected to match the other conditions (CEVMS and standard billboards) that the drivers would experience in the two respective cities. Also, the selection of DCZs was obviously constrained by what was available on the ground in these cities.

The results for the off-premise advertising conditions are consistent with Lee et al., who observed that 76 percent of drivers' time was spent looking at the road ahead in the CEVMS scenario and 75 percent in the standard billboard scenario.⁽⁹⁾ However, it should be kept in mind

that drivers did gaze away from the road ahead even when no off-premise advertising was present and that the presence of clutter or salient visual stimuli did not necessarily control where drivers gazed.

Do glances to CEVMS occur that would suggest a decrease in safety?

In DCZs containing CEVMS, about 2.5 percent of the fixations were to CEVMS (about 2.4 percent to standard billboards). The results for fixations are similar to those reported in other field data collection efforts that included advertising signs.^(12,11,9,13) Fixations greater than 2,000 ms were not observed for CEVMS or standard billboards.

However, an analysis of dwell times to CEVMS showed a mean dwell time of 994 ms (maximum of 1,467 ms) for Reading and a mean of 1,039 ms (maximum of 2,270 ms) for Richmond. Statistical comparisons of average dwell times between CEVMS and standard billboards were not significant in Reading; however, in Richmond the average dwell times to CEVMS were significantly longer than to standard billboards, though below 2,000 ms. There was one dwell time greater than 2,000 ms to a CEVMS across the two cities. On the other hand, for standard billboards there were three long dwell times in Reading; there were no long dwell times to these billboards in Richmond. Review of the video data for these four long dwell times showed that the signs were not far from the forward view when participants were fixating. Therefore, the drivers still had access to information about what was in front of them through peripheral vision.

As the analyses of gazes to the road ahead showed, drivers distributed their gazes away from the road ahead even when there were no off-premise billboards present. Also, drivers gazed and fixated on off-premise signs even though they were generally irrelevant to the driving task. However, the results did not provide evidence indicating that CEVMS were associated with long glances away from the road that may reflect an increase in risk. When long dwell times occurred to CEVMS or standard billboards, the road ahead was still in the driver's field of view.

Do drivers look at CEVMS more than at standard billboards?

The drivers were generally more likely to gaze at CEVMS than at standard billboards. However, there was some variability between the two locations and between type of roadway (arterial or freeway). In Reading, the participants looked more often at CEVMS when on arterials, whereas they looked more often at standard billboards when on freeways. In Richmond, the drivers looked at CEVMS more than standard billboards no matter the type of road they were on, but as in Reading the preference for gazing at CEVMS was greater on arterials (68 percent on arterials and 55 percent on freeways). The slower speed on arterials and sign placement may present drivers with more opportunities to gaze at the signs.

In Richmond, the results showed that drivers gazed more at CEVMS than standard billboards at night; however, for Reading no effect for time of day was found. CEVMS do have higher luminance and contrast than standard billboards at night. The results showed mean luminance of about 56 cd/m² in the two cities where testing was conducted. These signs would appear clearly visible but not overly bright.

SUMMARY

The results of these studies are consistent with a wealth of research that has been conducted on vision in natural environments.^(26,22,21) In the driving environment, gaze allocation is principally controlled by the requirements of the task. Consistent results were shown for the proportion of gazes to the road ahead for off-premise advertising conditions across the two cities. Average fixations were similar to CEVMS and standard billboards with no long single fixations evident for either condition. Across the two cities, four long dwell times were observed: one to a CEVMS on a freeway in the day, two to the same standard billboard on a freeway (once at night and once in the daytime), and one to a standard billboard on an arterial at night. Examination of the scene video and eye tracking data indicated that these long dwell times occurred when the billboards were close to the forward field of view where peripheral vision could still be used to gather visual information on the forward roadway.

The present data suggest that the drivers in this study directed the majority of their visual attention to areas of the roadway that were relevant to the task at hand (i.e., the driving task). Furthermore, it is possible, and likely, that in the time that the drivers looked away from the forward roadway, they may have elected to glance at other objects in the surrounding environment (in the absence of billboards) that were not relevant to the driving task. When billboards were present, the drivers in this study sometimes looked at them, but not such that overall attention to the forward roadway decreased.

LIMITATIONS OF THE RESEARCH

In this study the participants drove a research vehicle with two experimenters on board. The participants were provided with audio turn-by-turn directions and consequently did not have a taxing navigation task to perform. The participants were instructed to drive as they normally would. However, the presence of researchers in the vehicle and the nature of the driving task do limit the degree to which one may generalize the current results to other driving situations. This is a general limitation of instrumented vehicle research.

The two cities employed in the study appeared to follow common practices with respect to the content change frequency (every 8 to 10 seconds) and the brightness of the CEVMS. The current results would not generalize to situations where these guidelines are not being followed.

Participant recruiting was done through libraries, community centers and at a university. This recruiting procedure resulted in a participant demographic distribution that may not be representative of the general driving population.

The study employed a head-free eye tracking device to increase the realism of the driving situation (no head-mounted gear). However, the eye tracker had a sampling rate of 60 Hz, which made determining saccades problematic. The eye tracker and analyses software employed in this effort represents a significant improvement in technology over previous similar efforts in this area.

The study focused on objects that were 1,000 feet or less from the drivers. This was dictated by the accuracy of the eye tracking system and the ability to resolve objects for data reduction. In addition, the geometry of the roadway precluded the consideration of objects at great distances.

The study was performed on actual roadways, and this limited the control of the visual scenes except via the route selection process. In an ideal case, one would have had roadways with CEVMS, standard billboards, and no off-premise advertising and in which the context surrounding digital and standard billboards did not differ. This was not the case in this study, although such an exclusive environment would be inconsistent with the experience of most drivers. This presents issues with the interpretation of the specific contributions made by billboards and the environment to the driver's behavior.

Sign content was not investigated (or controlled) in the present study, but may be an important factor to consider in future studies that investigate the distraction potential of advertising signs. Investigations about the effect of content could potentially be performed in driving simulators where this variable could be systematically controlled and manipulated.

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Federal Highway Administration study confirms safety of digital billboards and signs



The U.S. Department of Transportation Federal Highway Administration has released a landmark study declaring that digital billboards do not pose a safety risk to passing motorists. For those within the industry, the results of this study come as no surprise. Numerous traffic studies and analyses performed in the last couple of decades have come to a similar conclusion.

The report, actually divided into two studies, is officially titled "Driver Visual Behavior In The Presence of Commercial Electronic Variable Message Signs." For the purposes of the studies, the FHA refers to digital billboards as Commercial Electronic Variable Message Signs. The studies sought to address three specific questions:

1. Do CEVMS attract drivers' attention away from the forward roadway and other driving-relevant stimuli?
2. Do glances to CEVMS occur that would suggest a decrease in safety?
3. Do drivers look at CEVMS more than at standard billboards?

To conduct the study, the FHA tracked participant's eye movements with an eye-tracking camera device mounted in the vehicle. This device was able to track the driver's eyeball movement and determine if the driver was looking ahead at the roadway or off to the side of the roadway at a static billboard or CEVMS.

Drivers in Richmond, Va., and Reading, Pa., participated in the study, and the research concluded that drivers do indeed look at digital billboards longer than they do at static billboards. Glance duration toward digital billboards averaged 0.379 seconds, while glances at static billboards were at 0.335 seconds at both test sites. Both of these measurements fall far below the two-second benchmark, which would constitute a hazard, according to the National Highway Traffic Safety Administration.

In conclusion, the study states, "The results did not provide evidence indicating that CEVMS, as deployed and tested in the two selected cities, were associated with unacceptably long glances away from the road. When dwell times longer than the currently accepted threshold of 2,000 ms [milliseconds] occurred, the road ahead was still in the driver's field of view. This was the case for both CEVMS and standard billboards."

This peer-reviewed study should help put to rest concerns that digital billboards, and other outdoor digital signs, pose a hazard to passing motorists. The study will also help pave the way for communities to bring this powerful outdoor advertising medium to their communities, benefiting not just local operators and advertisers but the entire local economy as well.

Topics: Advertising, Digital Billboards, DOOH Advertising, LED Signs, Trends / Statistics



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By [Ken Klein](#), EVP-Government Affairs, [OAAA](#).

I ran into a policy analyst (April 27) for the huge AAA auto club based in southern California. She said two things of note:

- A California lawmaker had invited AAA to join his effort to restrict digital billboards based on safety, but AAA declined because the science didn't show a problem
- I should read AAA's latest distraction report from its Foundation for Traffic Safety (based in Washington, DC)

I did. It's not about signs. The latest AAA report is about distraction *inside the vehicle*.



In-vehicle information systems (IVIS) create “moderate to high level cognitive workload” for drivers, said this research, conducted by experts at University of Utah. Further:

- Practice does not eliminate interference caused by in-car info systems
- Older drivers have more trouble figuring out in-car gadgets compared to younger drivers
- After drivers interact with in-car info systems, it takes 27 seconds to return to normal levels of performance. “At 25 MPH, drivers would have traveled more than three football fields in this interval.”

Thank you, AAA policy analyst.

The AAA safety study reminded me what Peter said about distraction a few days ago: *Billboards aren't the problem.*

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Peter is Congressman Peter DeFazio (D-OR), the top Democrat on the House Transportation & Infrastructure Committee.

Like the AAA motor club, the congressman is worried about information overload inside the vehicle, with more gizmos on the way.

DeFazio's home-state DOT (Oregon Department of Transportation) wants to "change cultural norms when it comes to distracted driving."

When Oregon's Transportation Director Matt Garrett says "cultural norms," he means driver behavior inside the vehicle.

Oregon commissioned new research that says:

- Three of four Oregon drivers admitted to driving while distracted, "mostly by using a cell phone."
- As passengers, more than eight of 10 feel uncomfortable riding with a driver who is distracted. But nearly half of those surveyed (by Oregon State University) "admitted to driving while distracted with passengers in the vehicle."
- A distracted-driver crash occurred every 2.5 hours, according to state data.

Driving into Portland (OR), I saw another example of government *using billboards on behalf of safety*.

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The kids-buckle-up message – on a digital bulletin — was posted by the National Highway Traffic Safety Administration (NHTSA).

When we hear terms like “distraction” and “changing cultural norms,” remember these basics:

- Billboards helped change culture norms, for safety, by increasing seatbelt usage and making impaired driving un-cool
- Serious, respected safety advocates like the AAA’s Foundation for Traffic Safety are focused on distraction inside the vehicle
- State and federal research shows that digital billboards are not distracting



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Fresno, Route 168

Digital Billboards

Photometric Analysis

Project Number
2019062.00

Prepared By:
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Date Submitted
18 March, 2019

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1.0 NARRATIVE

We (exp engineering) have conducted a photometric review of the digital billboard being proposed at along Route 168 in Fresno, CA..

Using the photometric software AGI32, Google Maps and other tools, we studied the screen's output brightness and location to illustrate the following:

- A) Output brightness of the sign relative to surrounding area with particular attention to the direction and amount of light shining upward toward the approach path of landing airplanes to the nearby airport
- B) The proposed location of the billboard relative to the high-mast sports lighting illuminating the adjacent sports field.
- C) A comparison of the proposed digital billboard to traditional, externally illuminated billboard.

The proposed billboard is to be 14'x48' with the top of the sign mounted at +65' above the ground with maximum screen brightness of 300 NITS (300 Candela per Square Meter) in the evening. Per OAAA guidelines, the proposed sign, displaying a full white image (for maximum brightness) should not exceed .3 foot candles over the surrounding ambient light levels at a distance of 250' in any direction.

The photometry used in this study is based on the specified Nichia series 336 LED modules, which output light horizontally at 90° and 45° vertically, at the evening output level of 300 Candela per Square Meter.

For purposes of comparing the relative position of the billboard to airlines on approach to land, we assumed a common 3° approach angle.

As we are unable to determine what the ambient light levels will be at the location, the studies were done assuming the worst-case scenario of no ambient light.

We have included graphical illustrations demonstrating the light levels in foot-candles we expect from the screen.

SHEET 1 of the attachment shows a pseudocolor rendering of the light distribution of the sign from overhead and output beam angle of the LEDs and shows the pattern in relation to the airline flight path above it.

SHEET 2 shows a section view of the pseudocolor rendering of the light distribution and output beam angle of the LEDs and shows the pattern in relation to the airline flight path above it.

SHEET 3 shows the proposed sign location relative to the adjacent softball field and compares the height of the sign to the high-mast sports lights.

SHEET 4 shows the perceived brightness of a digital billboard to a traditional front-illuminated billboard.

Conclusions

Given the limited amount of direct illumination shining beyond 90° nadir of the billboard, and that the proposed position of the billboard face is parallel to the flight direction of landing airplanes, and given the location relative to other existing tall, bright objects, we feel the sign should pose no distraction or other visual or physical impairment to the pilots on approach to land.

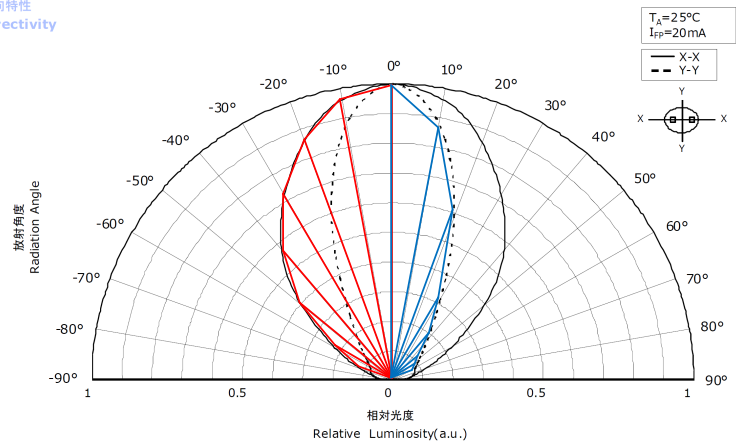
This report, prepared by **exp** Services Inc., is intended for the exclusive use of the City of Fresno, the Fresno Airport Land Use Commission, and Outfront Media. Neither **exp** Services Inc., the City of Fresno nor Outfront Media assume any liability for the use of this report, or for the use of any information disclosed in the report, or for damages resulting from the use of this report, by other parties.



Appendix

Foot-candle Level Graphic Sheets

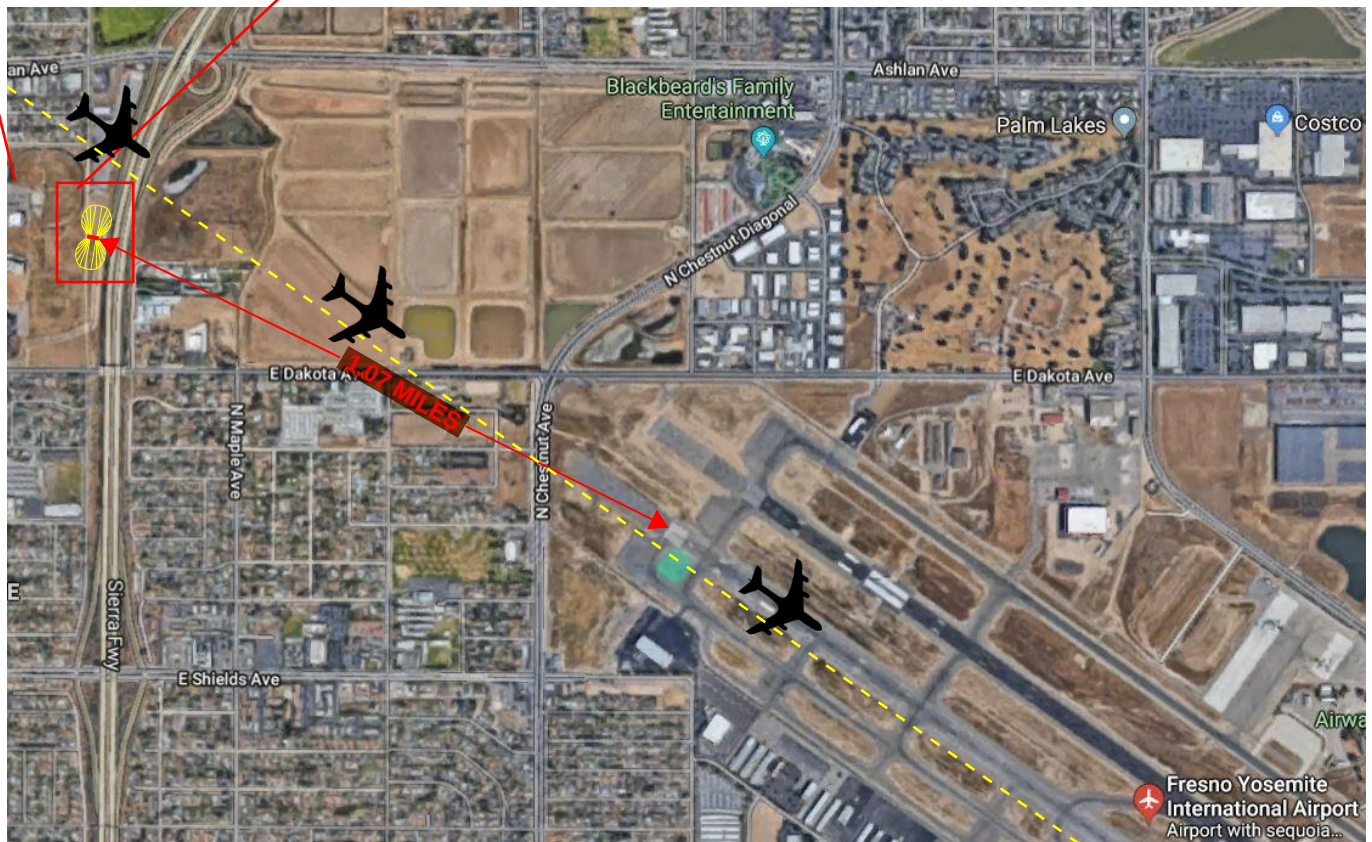




Nichia NSPX336 FOV 90
degree horizontal
45 degree vertical diodes
with narrow light broadcast
dispersion.

Horizontal dispersion mapped in red

Vertical dispersion mapped in blue



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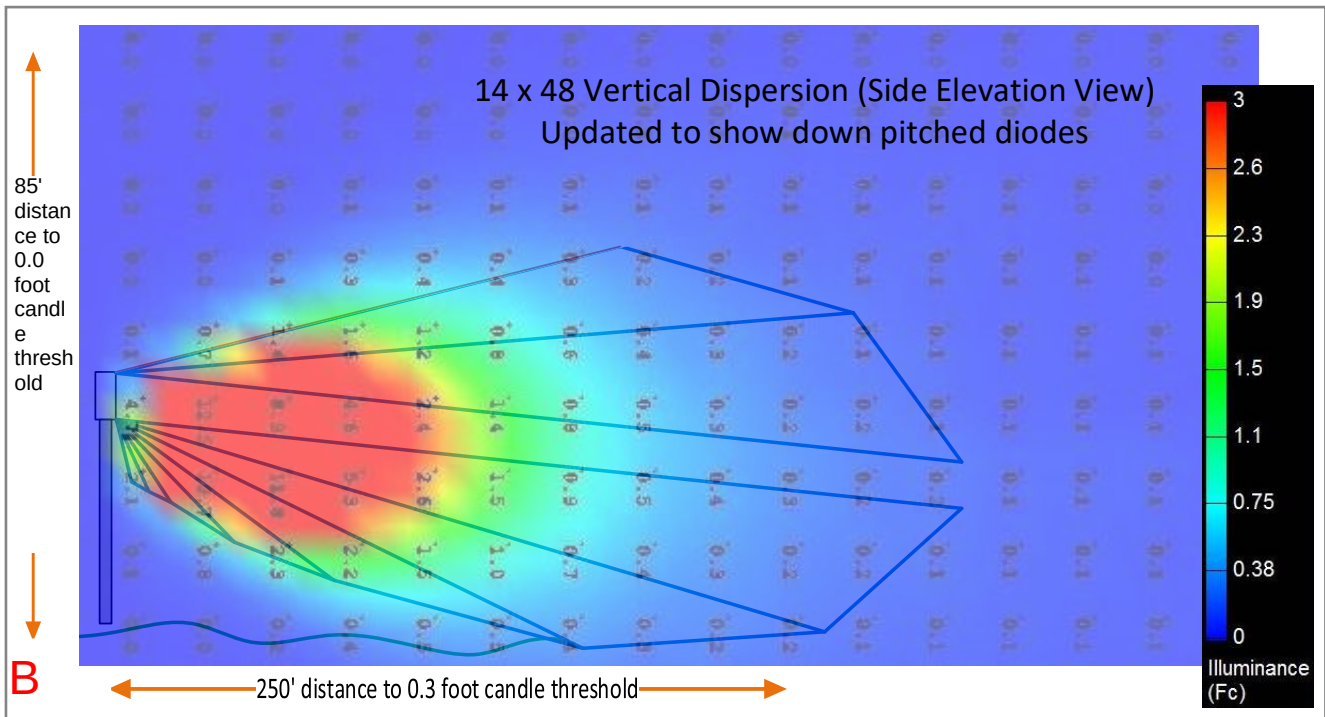
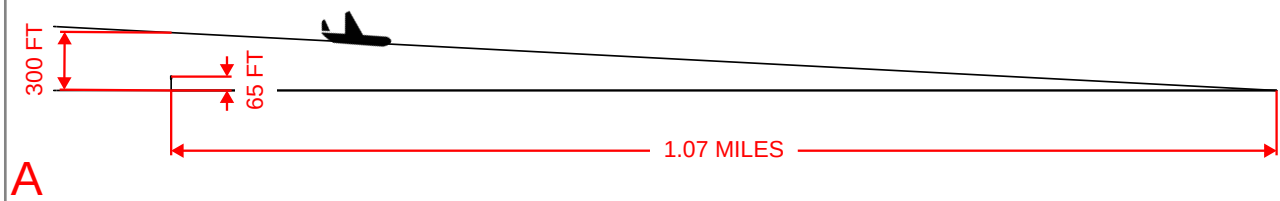
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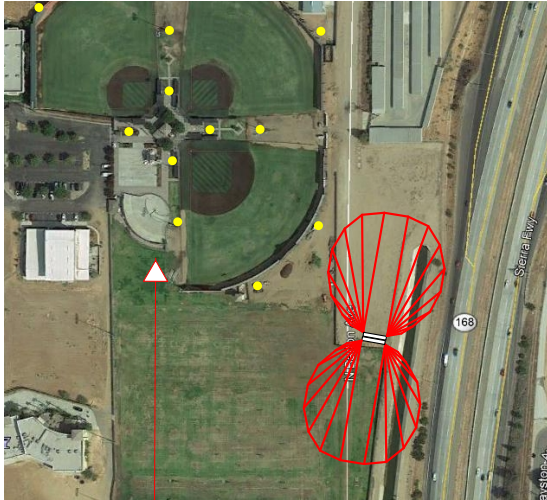
Typical 3° Plane Approach



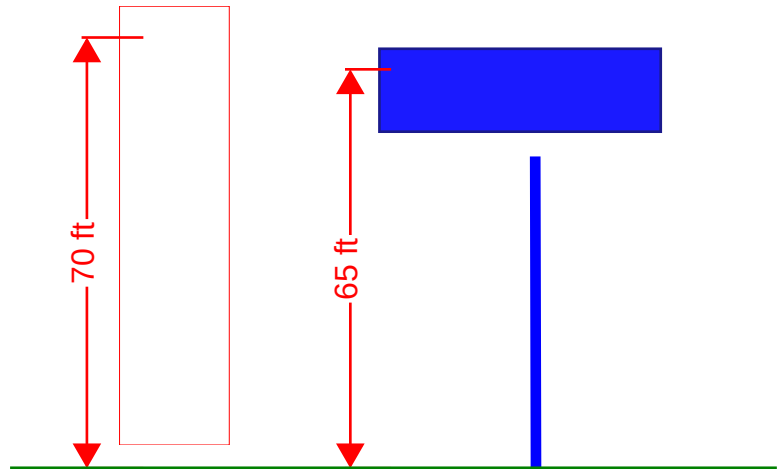
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Granite Park



Denotes location of
70ft tall Field Lighting

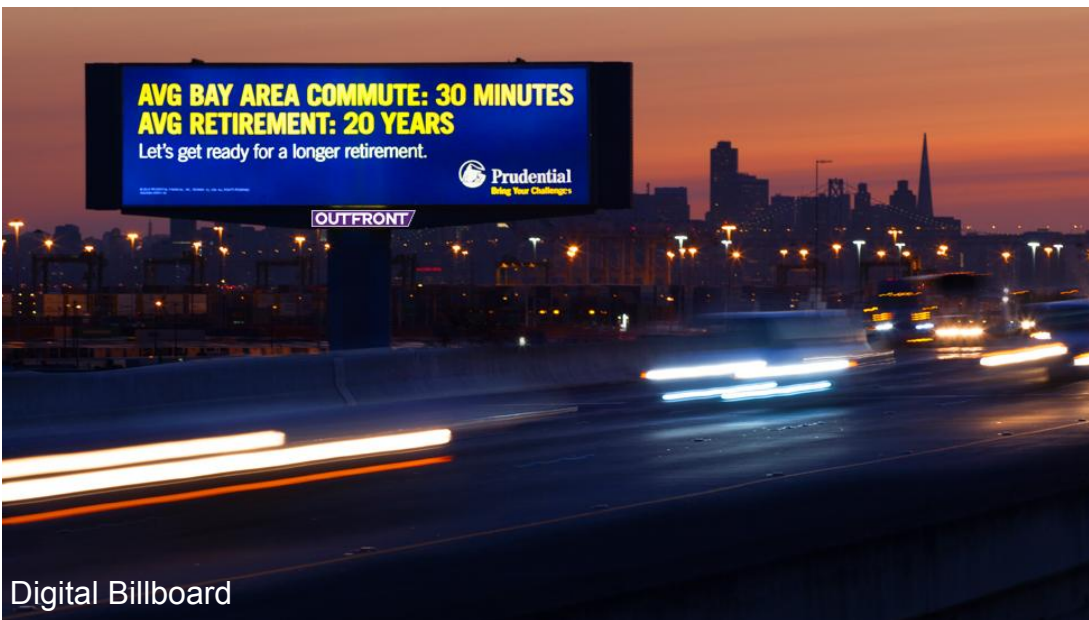
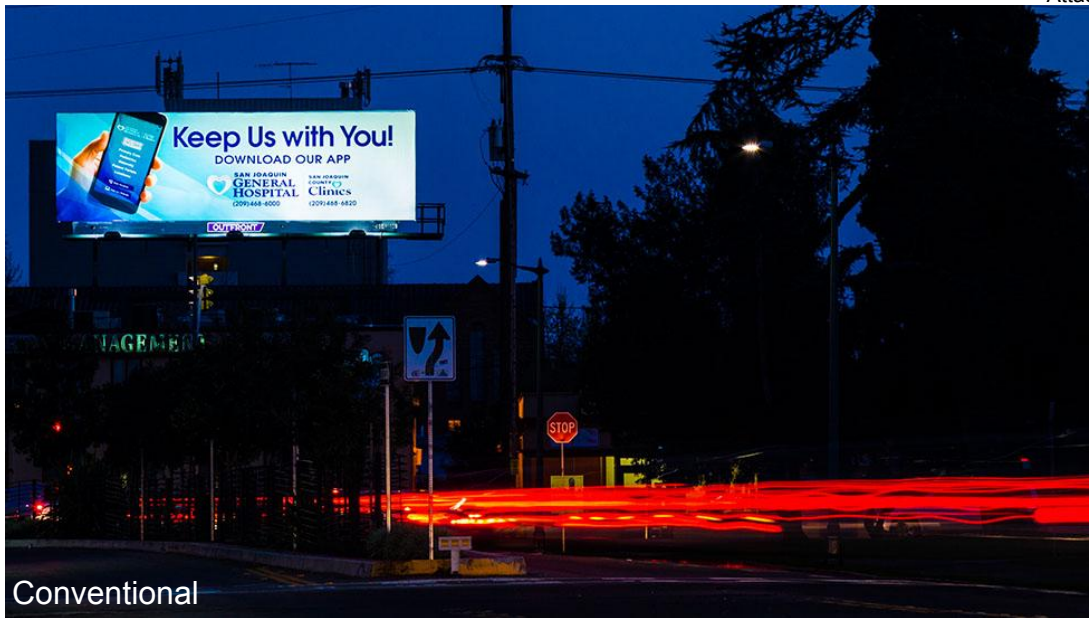


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As can be seen in the above images, the impact of a digital billboard compared to a conventionally lit billboard on the surrounding environments is comparably similar. While the digital billboard needs to be very bright during the day in order to be visible under sunlight, it dims during evening and night hours to visually comfortable levels. Additionally, the conventionally lit billboard is typically lit from below with the light source facing upwards while a digital billboard has no such upward facing point source.