CITY OF KEIZER MISSION STATEMENT

KEEP CITY GOVERNMENT COSTS AND SERVICES TO A MINIMUM BY PROVIDING CITY SERVICES TO THE COMMUNITY IN A COORDINATED, EFFICIENT, AND LEAST COST FASHION

AGENDA

KEIZER CITY COUNCIL
REGULAR SESSION
Monday, July 16, 2018
7:00 p.m.
Robert L. Simon Council Chambers
Keizer, Oregon

1. **CALL TO ORDER**

2. **ROLL CALL**

3. **FLAG SALUTE**

4. **SPECIAL ORDERS OF BUSINESS**
   a. Volunteer of the Quarter Award

5. **COMMITTEE REPORTS**

6. **PUBLIC TESTIMONY**

   This time is provided for citizens to address the Council on any matters other than those on the agenda scheduled for public hearing.

7. **PUBLIC HEARINGS**
   a. Keizer Development Code Text Amendment – Sign Code – KDC 2.308
   b. RESOLUTION - Authorization for Supplemental Budget – Phone System Upgrade

8. **ADMINISTRATIVE ACTION**
   a. Keizer Little League – 2017 Financial Review
   b. Waiver of Community Center Fee – Mid Willamette Valley Council of Governments Annual Business Dinner Meeting and Dinner
   c. RESOLUTION – Requesting Polk County Board of Commissioners to End Firearm Discharge and Enact Local Legislation and Take Other Action to Prohibit the Discharge of Firearms at Property Located at or Near 4000 River Bend Road NW, Salem, Oregon

9. **CONSENT CALENDAR**
   a. Approval of July 2, 2018 City Council Regular Session Minutes

10. **COUNCIL LIAISON REPORTS**

11. OTHER BUSINESS

This time is provided to allow the Mayor, City Council members, or staff an opportunity to bring new or old matters before the Council that are not on tonight's agenda.

12. WRITTEN COMMUNICATIONS

***To inform the Council of significant written communications*.**

13. AGENDA INPUT

August 6, 2018
7:00 p.m. City Council Regular Session

August 13, 2018
5:45 p.m. – City Council Work Session

August 20, 2018
7:00 p.m. City Council Regular Session

14. ADJOURNMENT

The City of Keizer is committed to providing equal access to all public meetings and information per the requirements of the ADA and Oregon Revised Statutes (ORS). The Keizer Civic Center is wheelchair accessible. If you require any service that furthers inclusivity to participate, please contact the Office of the City Recorder at least 48 business hours prior to the meeting by email at davist@keizer.org or phone at (503)390-3700 or (503)856-3412. Most regular City Council meetings are streamed live through the City's website and cable-cast on Comcast Channel 23 within the Keizer City limits. Thank you for your interest in the City of Keizer.

CITY COUNCIL MEETING:_____

AGENDA ITEM NUMBER:_____

TO: MAYOR CATHY CLARK AND CITY COUNCIL MEMBERS

THROUGH: CHRIS EPPLEY
CITY MANAGER

FROM: TRACY L. DAVIS, MMC
CITY RECORDER

SUBJECT: VOLUNTEER OF THE QUARTER AWARD

ISSUE:

The Volunteer Coordinating Committee has selected Richard Boyes as the recipient of the Volunteer of the Quarter award for second quarter of 2018. Mr. Boyes was nominated by West Keizer Neighborhood Association Board member Rhonda Rich and Keizer resident Meredith Mooney. The nomination letters are attached.

Mr. Boyes has been invited to the meeting to accept his volunteer award. Our thanks and congratulations to Mr. Boyes for his contributions to our community.

A new submission has been received for Volunteer of the Quarter Nomination

Name of Nominee:	Richard Boyes
Address of Nominee:	521 Chemawa Rd N
Nominee Phone Number or Contact Information:	503-393-6571
Each quarter the City of Keizer recognizes an individual or group of individuals for their contributions to the community. This award is designed to recognize the achievement and to encourage actions that enhance the city of Keizer, the community and the lives of our citizens. Process for Award of Nomination: (1) A written nomination form is submitted to the Keizer City Recorder, P.O. Box 21000, Keizer, Oregon or submitted by clicking the submit button on this form. (2) Additional letters of support, supplementary information such as pictures, news stories, biographical information, or other materials that show the project or contribution of the nominee may be included. (3) The nomination will be reviewed and decided by the Volunteer Coordinating Committee. The nominator may be requested to attend a meeting of the committee to answer questions and explain the nomination in further detail. (4) The award will then be presented at a regular meeting of the Keizer City Council. *Please provide a brief description, including the dates or time period, of the nominee's contributions and the reason why you are nominating for this award::	Richard has been removing trash from Chemawa Rd. N. from River Rd. to Keizer Rapids Park at least weekly for the past 5 years. He does this on his own because he enjoys keeping the street clean. He is a great example of individual volunteerism!
Please explain the impacts these contributions have had on the city of Keizer or the Keizer community::	Richard has contributed to the cleanliness of a highly used road in West Keizer. Since the KRP is more heavily used the amount of trash on the road has increased. Richard's work helps keep a major roadway in our community "beautiful".
Your Name:	Rhonda Rich, Board member of the West Keizer Neighborhood Association
Your Address:	1480 Rafael St. N.
Your contact information (email or phone):	rhondarich9@aol.com. 503-480-5782

Date :April 15, 2018
To: The Volunteer Coordinating Committee
From: Rhonda Rich, WKNA Board Member
Re: Volunteer of the Quarter Nomination for Richard Boyes

I am writing this letter in support of nominating Richard Boyes for Volunteer of the Quarter recognition for his contributions to our neighborhood and community. This nomination has been discussed at the West Keizer Neighborhood Association Board and General meetings. The WKNA board fully supported this nomination at the March 1st meeting.

I met Richard about a year ago. I was driving down Chemawa Rd. and noticed an elderly gentleman reaching out with a grabber and placing a paper cup in a tote that he was pulling behind him. I stopped and spoke with him and thanked him for taking his time to clean up the street.

The WKNA has been performing quarterly cleanups of Chemawa Rd. through the Adopt-a-Street program since June of 2013 until fall of 2017. I had asked Richard if he would like to join us in our efforts. He politely said "no" and that he has a routine of walking up and down Chemawa Rd. at least once a week collecting all kinds of trash and enjoys doing it.

As President of the WKNA from 2005-2015, I have always encouraged our members to stop and pick up trash on Chemawa Rd or any other streets in our neighborhood where they may see a cup, bottle, fast food container, cardboard, etc. I tried to impress upon our residents that if everyone did a little "good deed" that our neighborhood would be a "better, cleaner place to live" and that people may be less likely to discard trash in our streets.

So, needless to say I was impressed and excited that Richard, just an everyday citizen, was going out of his way and taking of his time to do a little something for our community. He has done this weekly for the last 5 years without being asked and not expecting any recognition for his contribution to keeping Chemawa Rd. clean from River Rd. to Keizer Rapids Park. He plans to continue his "good work" as long as he is able.

I hope that Richard's recognition encourages some of our citizens as individuals to take on responsibilities to make Keizer more welcoming and that if someone sees someone doing the extraordinary that they stop and thank them.

April 15, 2018

Volunteer Coordinating Committee,

I would like to nominate my neighbor Richard Boyes, as Volunteer of the quarter. Richard and I have been neighbors for almost 15 years. He has actually lived in this neighborhood for almost 50 years. When we moved in, Richard and his wife were easy to get to know. I would often find him mowing a mutual neighbors lawn. He would fix things for her and just be on the lookout for needs in the neighborhood. His good neighbor attitude spilled out into the surrounding streets as our elderly neighbor had to move out and he no longer had her property to care for. Now you can find him several days a week up and down Chemawa, McNary Highs School campus and up River Rd. from Chemawa to Lockhaven. He totes a basket on wheels and a trash grabber. Up and down the streets he goes picking up trash and even the tedious cigarette butts! He is a humble servant to his community and was even very reluctant to accept this nomination. However, he said that if it will encourage others to step out and care for their neighborhoods, that he'd accept the nomination.

I am thankful for Richard! He and his wife are such a blessing to our neighborhood. When I have hosted parties and even a wedding in our back yard they have gifted us with our choice of flowers from their beautiful gardens to beautify the event. The bride was elated at their generosity!

Richard and Arcile are getting along in years, but their neighborly hearts will always find a way to give! We need more neighbors like Richard.

Thank you for your consideration,

Meredith Mooney
West Keizer Neighbor

TO: **CITY COUNCIL**

THRU: **CHRIS EPPLEY, CITY MANAGER**

FROM: **NATE BROWN, COMMUNITY DEVELOPMENT DIRECTOR, SHANE WITHAM, SENIOR PLANNER**

DATE: **JULY 16, 2018**

SUBJECT: **PROPOSED TEXT AMENDMENT – SECTION 2.308 (SIGNS)**

Attachments:

- **Section 2.308 (Signs)**
- **Section 3.103 (Conditional Use Permits)**
- **Minutes of Public Hearings before the Planning Commission Concerning Signs**
- **Written Testimony Received and Presented to Planning Commission**
- **Written Testimony Received after close of public hearing at Planning Commission**

DISCUSSION: The Planning Commission held a public hearing on August 9, 2017 regarding proposed changes to KDC Section 2.308 (Signs) which was carried forward to the September 13, 2017 Planning Commission meeting to allow for additional input and testimony to be provided regarding the matter. At the September 13, 2017 meeting, staff sought and received direction from the Planning Commission regarding proposed changes to the sign code. Direction was given regarding regulations pertaining to electronic message signs, temporary and portable signs, window signs, and special event signage. The issues revolving around the ramifications of the Reed v. Town of Gilbert Supreme Court case—and its applicability in Oregon, as well as the out of date amortization language was deferred to the legal department.

On March 14, 2018, the Planning Commission held a new public hearing to revisit the proposed changes to the sign code, specifically reflecting the previous direction given by the Planning Commission at previous meeting, and integrating the legal department's input.

The following chart outlines the changes proposed, after the direction given by the Planning Commission at the September 2017 meeting:

CURRENT EXISTING TEXT	PROPOSED TEXT
Amortization/Non-conforming Language: Establishes May 1997 as a timeframe for bringing non-conforming signs into compliance	Language has been updated. Clarifies that "non-conforming" signs are to be brought into compliance as a function of review and approval of sign permits.
Election Signs: Allows unlimited "election" signs 45 days prior to and 7 days after an election	Eliminates "election sign" category. Allows unlimited temp/portable signs 45 days prior and 7 days after an election, regardless of content

Real Estate Sign: Allows a real estate sign in addition to other portable/temporary sign provisions.(6 sqft for residential, 16 sqft for commercial properties)	Eliminates "real estate sign" category. Creates special event permit which can be used to display an oversized portable sign of any type
Window Signs. For commercial or industrial buildings, signs painted or hung on the inside of windows.	Requires that no more than 50% of the surface area of the window in which they are hung may be covered
Portable / Temporary Signs. Portable Signs: 50 foot separation, 1 per lot, 120 day time limit, does not include wind feather signs Temporary Signs: Includes wind feathers, 1 per lot, 120 day time limit	Portable Signs: 25 foot separation, 1 per business/storefront, no time limit, includes wind feathers Temporary Signs: Includes only banners or signs attached to a building, 1 per storefront, 120 day time limit
Electronic Message Signs (EMS): must remain static and unchanging for a period no less than 15 minutes for commercial (24 hours for public), and are only allowed as a freestanding sign. Illumination standards are based on NITS	Electronic Message signs must remain static and unchanging for a period no less than 60 seconds. Allow for wall signs. No change to illumination standard, as Salem has not adopted new language
Secondary Frontage: Allowance for secondary frontage sign in an integrated business center when a building has more than one street frontage	Allows secondary frontage signs in non-integrated business centers as well.
"Grand openings" or other special occasions. Currently there is no allowance for businesses to display oversized/multiple temporary or portable signs	Allowance for 2 different types of permits: 1. Allows any combination of oversized banners & multiple portable signs for a 2 week time period (2x/year max) 2. Allows 1 oversized portable sign no larger than 16 square feet for 120 days

While the above chart was not an exhaustive list of all the proposed text changes, it reflects the items that were identified as needing additional discussion and direction given.

At the March 14, 2018 Planning Commission meeting, the Planning Commission changed its previous decision on two major issues: The Planning Commission recommended that proposed language for window signs be changed to remove the proposed regulation of 50% maximum (to have no limit), and to reduce the period of change of EMSs from the recommended 60 seconds (currently the KDC requires 15 minutes) down to 15 seconds. There was only a single testimony at that meeting, provided by Jonathan Thompson.

Though the draft language accurately reflects the Planning Commission's recommendation, staff believes the period of change for EMSs should be 60 seconds

based on several factors, among them being the *long* history of the sign code is based on preserving a positive "sense of place" and has *from its inception* prohibited attention grabbing signs of all kinds.

Additional, non-solicited testimony was received after the March Planning Commission meeting (see attachment) from Mr. Rick Halvorson where he is urging the period of change to be "of at least 30 seconds and one minute would be even better" because of the distraction factor such change brings. Staff would agree with Mr. Halvorson as yet another factor arguing for a more controlled period of change.

The Keizer/Salem Area Senior Center also submitted a letter regarding electronic message signs due to the fact that currently EMSs are not allowed in the Residential Medium Density zone. Council may wish to allow EMSs for Semi Public uses in an RM zone under certain circumstances.

Of specific importance in this process is the fact that before a staff proposal was even solidified, on July 25, 2017 staff held a meeting with the Keizer Chamber of Commerce to solicit their input and suggestions for changes. Several of the changes in the current recommendation are a direct result of that meeting. Such things as more leniency on temporary signs, expansive allowance for special events, and allowing EMSs as wall signs are significant changes which relax some of the sign controls in order to be more responsive to the needs of the business community. The relaxing of the time period from the current 15 minutes was also an agreed upon need, however the amount of time was not agreed upon.

RECOMMENDATION:

The Keizer City Council should open the public hearing and take testimony. Council should then decide whether to continue the public hearing, or close the hearing and direct staff to prepare an Ordinance implementing changes to the Keizer Development Code.

2.308 SIGNS

2.308.01 Purpose

The purpose of these sign regulations is to provide equitable signage rights, reduce signage conflicts, promote traffic and pedestrian safety, and, increase the aesthetic value and economic viability of the city, all by classifying and regulating the location, size, type and number of signs and related matters, in a content-neutral manner. (5/98)

2.308.02 Definitions

For the purposes of this Chapter, the following definitions shall apply: (5/98)

Alteration or Altered: Any change in the size, shape, method of illumination, position, location, construction, or supporting structure of a sign. A change in sign copy or sign face alone shall not be considered an alteration. (5/98)

Area: The area of a sign shall be the entire area within any type of perimeter or border which encloses the outer limits of any writing, representation, emblem, figure, or character. If the sign is enclosed in a frame or cabinet the area is based on the inner dimensions of the frame or cabinet surrounding the sign face. When a sign is on a base material and attached without a frame, such as a wood board or Plexiglas panel, the dimensions of the base material are to be used. The area of a sign having no such perimeter, border, or base material shall be computed by enclosing the entire area within a standard geometric figure or combination of no more than two (2) connected standard geometric figures (e.g., rectangle, circle, parallelogram, ~~or a~~ triangle) of the smallest size sufficient to cover the entire message of the sign and computing the area of the sum of the geometric figures~~parallelogram or a triangle~~. For the purpose of computing the number of signs, all writing included within such ~~a~~ geographic figure or two (2) connected geographic figures~~border~~ shall be considered one sign, except for multi-faced signs on a single sign structure, which shall be counted as one sign per structure. The area of multi-faced signs shall be calculated by including only one-half the total area of all sign faces. (5/98)

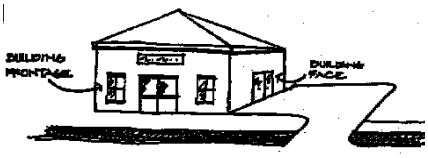
Sign Area

Awning Sign

Awning: A shelter supported entirely from the exterior wall of a building and composed of non-rigid materials, except for the supporting framework. (5/98)

Building Face: The single wall surface of a building facing a given direction. (5/98)

Building Frontage, Primary: The portion of a building face most closely in alignment with an adjacent right-of-way or fronting a parking lot when so defined, as allowed in this chapter. A gasoline service station may use the overhanging canopy as a substitute for building frontage when computing the allowable sign area. The longest side of the canopy shall be used to compute the allowable sign area. (Ord. 2005-533 11/05)



Building Frontage and Face

Building Frontage, Secondary: Buildings located on lots abutting more than one Right of Way or a parking lot may designate one building face as a secondary building frontage. (Ord. 2005-533 11/05)

Canopy Sign: A sign hanging from a canopy or eve, at any angle relative to the adjacent wall, the lowest portion of which is at least eight (8) feet above the underlying grade. (5/98)

Construct: Build, erect, attach, hang, place, suspend, paint in new or different word, affix, or otherwise bring into being. (5/98)

~~Election Signs: Those signs which relate to an election, initiative or political viewpoint. Such signs will otherwise meet the specifications of Temporary Signs.~~ (5/04 – Ord 2004-498)

Electronic Message Sign: Signs that incorporate as part of, or wholly, an electronic message or display by means of light emitting diodes, plasma, electronic ink, or other means that allow that display to be changed through electronic controls. ~~Further, an electronic message sign cannot be a wall sign.~~ (10/08 – Ord 2008-581)

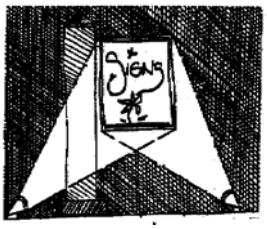
Free-Standing Sign

Finish Ground Level: The average elevation of the ground (excluding mounds or berms, etc. located only in the immediate area of the sign) adjoining the structure or building upon which the sign is erected, or the curb height of the closest street, which ever is the lowest. (5/98)

Flashing Sign: A sign any part of which pulsates, scrolls, flutters, animates, lights intermittently, or blinks on and off. (10/08)

Free-Standing Sign: A permanent sign supported by one or more uprights, poles or braces placed in or upon the ground, or a sign supported by any structure primarily for the display and support of the sign, ~~.~~the structure of which will not be calculated as part of the overall sign area. (see "Area") (5/98)

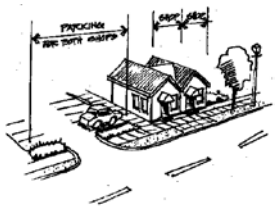
Incidental Signs: A sign that is normally incidental to the allowed use of the property, but can contain any message or content. Such signs can be used for, but are not limited to, nameplate signs, warning or prohibition signs, and directional signs not otherwise allowed. (5/98)



Indirect Illumination

Indirect Illumination: A source of illumination directed toward such sign so that the beam of light falls upon the exterior surface of the sign. (5/98)

Integrated Business Center: A group of two or more businesses which are planned or designed as a center, and share a common off-street parking area or access, whether or not the businesses, buildings or land are under common ownership. (5/98)


Small Integrated Business Center

Internal Illumination. A source of illumination from within a sign. (5/98)

~~Joint Use Sign: When two of more businesses combine part or all of their total allowed sign area into free-standing sign for each common frontage of such business.~~ (5/98)

Large Integrated Business Center

Multi-faced Sign: A sign which has two or more identical size sign faces, contained in a single sign structure. (5/98)

Multi-family Dwelling: A residential structure or complex of structures that include three or more separate dwelling units, whether rented or owned by the occupants. (5/98)

Mural: An illustration (with or without words or numbers) which is painted or otherwise applied (without projections) to an outside wall of a structure. (5/98)

Joint-Use Sign

Nit: Nit is used as a measurement of luminance, where the Nit is equal to one candela per square meter (1cd/m2). A candela is a unit of measurement of the intensity of light, where one candela is the monochromatic radiation of 540THz with a radiant intensity of 1/683 watt per steradian

Multi-Faced Sign

in the same direction. By way of example, an ordinary wax candle generates approximately one candela. (10/08)

Nonconforming Sign: Any sign which lawfully existed~~exists~~ prior to May 7, 1990~~the effective date of this chapter~~ but, which due to the requirements adopted herein, no longer complies with the height, area and placement regulations or other provisions of these regulations. (5/98)

– Portable Signs

Owner: As used in these regulations, "owner" means owner or lessee of the sign. If the owner or lessee of the sign cannot be determined, then "owner" means owner or purchaser of the land on which the sign is placed. (5/98)

Portable Sign: A sign that is, or similar to, an A-frame sign, sandwich board sign, yard sign, wind feather or feather flag, or a sign attached to wood or metal frames and designed to be self-supporting and movable. Wind feathers or feather flags may be placed on a stand or placed in the ground. Portable signs are not to be considered temporary signs as defined and used in this chapter. (12/10)

Projecting Signs: A sign the face of which is not parallel to the wall on which it is mounted. (11/05)

~~Real Estate Sign: A sign for the purpose of rent, lease, sale, etc. of real property, building opportunities, or building space.~~ (5/98)

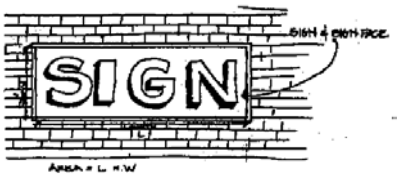
Roof Line and Roof Sign

Roof Line: Either the eaves of the roof or the top of the parapet, at the exterior wall. (A "mansard roof" is below the top of a parapet and is considered a wall for sign purposes.)

Roof Sign: A sign or any portion of which is displayed above the highest point of the roof, whether or not such sign also is a wall sign. (5/98)

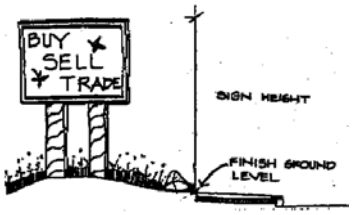
Rotating/Revolving Sign: A sign, all or a portion of which, moves in some manner. (5/98)

Sign: Any writing, including letter, word, or numeral; pictorial presentation, including mural, illustration or decoration; emblem, including device, symbol, logo or trademark; flag, including banner or pennant; or any other device, figure or similar thing which is a structure or any part



Sign Face

thereof, or is attached to, painted on, or in any other manner represented on a building or structure or device; and is used to announce, direct attention to, or advertise; and is visible from any public right-of-way. (5/98)

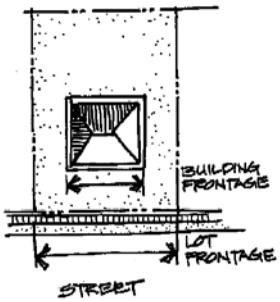


Sign Height

Sign Face: Surface of a sign containing the message. The sign face shall be measured as set forth in the definition for "area."

Sign Height: The distance from the finish ground level, to the top of the sign or the highest portion of the sign structure or frame, whichever is greater. (5/98)

Sign Structure: The supports, uprights, braces, framework and other structural components of the sign. (5/98)



Street Frontage

Street Frontage: That portion of a property that abuts a paved street right-of-way and measured by the lineal distance of the property adjacent to such right-of-way. (5/98)

Temporary Sign

Temporary Business: A business of a temporary nature authorized through a Temporary Business Permit issued by the City of Keizer. (5/98)

~~Temporary Sign. A sign not permanently affixed to a structure on a property. A sign that is, or is similar to, a banner or wind feather sign which may be made of canvas, cloth, rigid plastic or paper, or vinyl.~~ (12/10)

Wall Sign

Temporary Sign: A sign that is, or is similar to, a banner and is attached, but not permanently affixed to a building, and which may be made of canvas, cloth, rigid plastic, paper, vinyl, or other lightweight flexible material.

Wall Sign: A permanent sign attached to, erected against or painted on a wall of a building or structure, with the exposed face of the sign in a plane approximately parallel to the face of said wall. A sign painted on an awning in which the face of the sign is approximately parallel to the wall shall also be considered a wall sign. (5/98)

2.308.03 Review Procedures

A. Permit Required. Except as specifically excluded herein, no property owner, lessee or contractor shall construct or alter any sign without first obtaining a valid permit to do so. (5/98)

~~B. Current Signs. Owners of conforming or nonconforming signs existing as of December 4, 1989 are not required to obtain a permit until the end of the abatement period described in Section 2.308.04.C. (5/98)~~

B~~C~~. Permit Fees. Permit fees shall be established from time to time by City Council resolution. (5/98)

C~~D~~. Application Requirements. An application for a sign permit shall be made on a form prescribed by the Zoning Administrator. The application shall include, at a minimum, a sketch drawn to scale indicating the proposed sign and identifying existing signs on the premises, the sign's location, graphic design, structural and mechanical design and engineering data which ensures its structural stability. The application shall also contain the names and address of the sign company, person authorizing erection of the sign and the owner of the subject property. (5/98)

The Zoning Administrator shall issue a permit for a sign unless the sign is in violation of the provisions of these regulations or other provisions of the Keizer Zoning Ordinance. Sign permits mistakenly issued in violation of these regulations or other provisions of the Keizer Zoning Ordinance are void. The Zoning Administrator may revoke a sign permit if he finds that there was a material and misleading false statement of fact in the application for the permit. (5/98)

D~~E~~. Design, Construction, and Maintenance. All signs shall be designed, constructed, and maintained according to the following standards: (5/98)

1. Compliance with Building Codes. All signs shall comply with the applicable provisions of ~~Uniform~~ the Building Code in effect at the time of the sign permit application and all other applicable structural, electrical and other regulations. The issuance of a sign permit under these regulations does not relieve the applicant of complying with all other permit requirements. (5/98)

2. Materials. Except for banners, flags, portable signs, temporary signs, and window signs conforming in all respects with the requirements of these regulations, all signs shall be constructed of permanent materials and shall be permanently attached to the ground, a building, or other structure by direct attachment to a rigid wall, frame, or structure. (5/98)

3. Maintenance. All signs shall be maintained in a good structural condition and readable at all times. (5/98)

4. Owner Responsibility. The owner shall be responsible for its erection and maintenance and its compliance with the provisions of these regulations or other laws or Ordinances regulating signs. (5/98)

5. Aesthetics. All signs shall be professional in appearance, constructed in a workmanship like manner to professional standards. (12/10)

2.308.04 Nonconforming Signs

A. Any sign not complying with these regulations is prohibited and constitutes a violation.

~~Alteration of Nonconforming Sign Faces. Nonconforming signs are subject to the following provisions regarding alteration:~~ (5/98)

~~1. Change Permitted. Within the abatement period described in Section 2.308.04.C., a~~No alteration or replacement of any nonconforming sign shall be allowed. ~~A change in sign face alone is allowed without requiring compliance with these regulations.~~ (5/98)

~~2. Termination of Nonconforming Sign. Within the abatement period described in Section 2.308.04.C., w~~When a nonconforming sign face is damaged or destroyed by fire, flood, wind, or other calamity or act of God, such sign face may be restored to its original condition provided such work is completed within sixty (60) days of such calamity. However, a sign structure or support mechanisms so damaged shall not be replaced except in conformance with the provisions of these regulations. (5/98)

B. Permits for Properties with Nonconforming Signs. (5/98)

1. Businesses in Integrated Business Centers. For individual businesses in integrated business centers, all signs of the individual business must comply prior to issuance of sign permits for new or altered signs for such business. No free-standing sign permits will be issued for the integrated business center, unless all free-standing signs comply. (5/98)

2. Businesses Not in Integrated Business Centers. No permits shall be issued for new or altered signs unless all signs of the individual business comply with these regulations~~, except as set forth in Section 2.308.04.B.4.~~ (5/98)

3. ~~Nonconforming Sign Area. Except as set forth above and in Section 2.308.08.B.4., all conforming and/or nonconforming signs in existence as of the date of the permit application shall be included in the total allowed area, number or size when reviewing applications for new or altered signs to be allowed on the property.~~ (5/98)

4. ~~Exception for Non-Owned Signs. Signs which are not owned or controlled by the property owner or lessee prior to May 7, 1990, and which were constructed or installed prior to May 7, 1990, shall not be included in the total allowed area for sign permits granted prior to May 7, 1997.~~ (5/98)

C. ~~Abatement of Nonconforming Signs. Permanent signs in existence on May 7, 1990 that are not in conformance with the provisions of this Ordinance shall be regarded as nonconforming signs and must be removed, altered, or replaced so as to conform on or before May 7, 1997. The period from the date of the enactment of these regulations to May 7, 1997, shall be described as the "abatement period." Nonconforming signs remaining after the abatement period ends shall be considered illegal signs. Temporary and portable signs that are not in conformance with the provisions of this Ordinance shall be regarded as nonconforming and shall be removed on or before September 7, 1990.~~ (10/08)

~~The Zoning Administrator shall notify non-conforming permanent sign owners by certified mail of the conformance deadline at least two years prior to such deadline as a public service. Failure to be notified of the deadline shall not relieve the owner of responsibility to conform with this Ordinance within the time period herein. Properties annexed to the City after the effective date of this Ordinance shall have 7 years following annexation in which to conform to these regulations, with the exception of temporary signs that shall conform to the regulations within 90 days following annexation.~~ (5/98)

Electronic Message Signs which are legally placed and maintained in all respects on or before October 6, 2008 shall be allowed to remain as non-conforming signs and do not have to be brought into compliance. However, once a non-conforming Electronic Message Sign is removed, any replacement sign must comply in all respects with these regulations. (10/08)

D. Abandoned Signs. All signs for a business shall be removed within ~~30~~120 days after that business ceases to operate on a regular basis, and the entire sign structure or structures shall be removed within 12 months of such cessation of operation. (5/98)

~~E. Minor Nonconforming Signs. Individual signs that otherwise comply and are existing as of May 7, 1990, that are within 5% of both the allowed area (total and per sign) and the allowed height as set forth in~~

these regulations are allowed to remain as nNonconforming signs and do not have to be brought into compliance. However, once a nonconforming sign is removed, any replacement sign must comply in all respects with these regulations. (5/98)

2.308.05 Signs Generally Permitted

Subject to the limitations in Sections 2.308.04.C., 2.308.07 and 2.308.08, the following signs and sign work are permitted in all zones. These signs shall not require a permit, and shall not be included when determining compliance with total allowed area: (5/98)

A. Sign Copy. Painting, change of sign face or copy and maintenance of signs legally existing on the effective date of this Ordinance. If structural changes are made, the sign shall conform in all respects with these regulations. (5/98)

B. Temporary Signs. Temporary signs that do not exceed 16 square feet in area. No lot may be displayed for a maximum of temporary signs for more than 120 days in any calendar year. Only one temporary sign per lot storefront or residenceresidential structure may be displayed at a time except during the period 45 days preceding and seven days following governmental elections, signs which relate to such elections during which time temporary signs may be unlimited in number. Paper signs may only be used for single day events. (12/10)

C. Real Estate Signs. Signs that advertise the sale, rental or lease of premises upon which the sign is located. Commercial Properties may display a real estate sign not exceeding 16 square feet in area. Residential properties may display a real estate sign not exceeding 6 square feet in area. (12/10)

CD. Government Signs. Signs posted by or under governmental authority including legal notices, traffic, danger, no trespassing, emergency, city identification, signs related to public services or safety, and signs approved by City Council resolution for special events or activities. (12/10)

DE. Development Signs. One sign not over 32 square feet for a residential development or subdivision, and located at each street entrance to a residential subdivision or residentialthe development. (5/98)

EF. Incidental. Incidental signs that do not exceed 6 square feet. Such signs shall not be mounted on permitted freestanding sign structures. (5/98)

FG. Flags. Flags on permanent flag poles that are designed to allow raising and lowering of the flags. Flagpoles shall either be freestanding or shall

be mounted on the building but if mounted on the building may not be taller than the peak of the roof. Flags shall not exceed 25 square feet in area. (5/98)

GH. Interior Signs. Signs within a building. (5/98)

HI. Window Signs. For commercial or industrial buildings, signs painted or hung on the inside of windows, or otherwise affixed (such as window clings) to the surface of a window with its message intended to be visible to the exterior environment, provided such signs shall cover no more than 50% of the surface area of the window in which they are hung. (5/98)

J. Non-profit Signs. A non-profit organization may display a portable sign subject to the following: (5/98)

1. Three signs per organization at one time. (5/98)

2. Maximum sign area: 16 square feet. (5/98)

3. The sign shall be displayed no more than six times in any 365 day period, and shall not be displayed longer than five days each time. (5/98)

4. The sign shall not be placed on public property or in any right-of-way. (5/98)

5. The non-profit organization shall request and receive consent from the property owner of the property on which the sign is placed. (5/98)

6. If requested, the non-profit organization shall provide appropriate proof that such organization is organized not to make a profit, but for charitable, educational, religious, or philanthropic purposes. (5/98)

IK. Residential Signs. Residential signs, pursuant to requirements in Section 2.308.07. (5/98)

L. Election Signs. During the period of forty-five (45) days prior and seven (7) days after any governmental election, signs which meet the definition of temporary or portable signs, and which pertain to such election, may be unlimited in number. (12/10)

JM. Portable Signs. Portable signs may be displayed for a maximum of 120 days in any calendar year, and aresigns are limited to 6 square feet in area, with the exception that wind feather/feather flag signs may be up

to 16 square feet in area. One portable sign per storefront or ~~residence~~ residential structure is allowed except during the period 45 days preceding and seven days following governmental elections, during which time portable signs may be unlimited in number. The following additional standards apply to portable signs: (12/10)

~~1. Portable signs located within 10 feet of the main entry of a business may be displayed without limit to time.~~ (12/10)

~~2.~~1. Portable signs ~~not located adjacent to a business entrance~~ may not be within ~~50~~ 25 feet of any other portable sign on the same lot or less than ~~10~~ 5 feet from a side lot~~property~~ line. (12/10)

~~3.~~2. Portable signs must be located on private property, and may not be within any public sidewalk easement or right of way. If located along a public street, signs must be located behind the sidewalk regardless of property line location. (12/10)

~~4.~~3. Portable signs cannot impede sidewalks, exits, or other pedestrian, vehicular, or bicycle way. (12/10)

~~5. Portable signs may only be displayed during business hours.~~ (12/10)

2.308.06 Prohibited Signs

The following signs are prohibited, and are subject to immediate code enforcement action including but not limited to the issuance of citations and/or confiscation under the Keizer Uniform Nuisance Abatement Ordinance: (5/98)

A. Tethered Signs. Balloons or similar types of tethered objects, including strings of pennants. (5/98)

B. Roof Signs. Roof signs or signs which extend higher than the roof line. (5/98)

C. Odor, Visible Matter. Signs that emit odor, visible matter, or sound, however an intercom system for customers remaining in their vehicles, such as used in banks and "drive through" restaurants, shall be allowed. (5/98)

D. Wire Supports. Signs that use or employ side guy lines of any type. (5/98)

E. Obstructing Signs. Signs that obstruct any fire escape, required exit, window or door opening used as a means of egress. (5/98)

F. Utility Lines. Signs closer than 24 inches horizontally or vertically from any overhead power line or public utility guy wire. (5/98)

G. Vehicle, Trailer Signs. No vehicle, trailer, or trailer mounted reader boards shall be parked on a public right-of-way or public property, or on private property so as to be visible from a public right-of-way which has attached thereto or located thereon any sign or advertising device for the basic purpose of providing advertisement of products or directing people to a business or activity located on the same or nearby premises. This provision applies where the primary purpose of a vehicle is for advertising purposes and is not intended to prohibit any form of vehicular sign, such as a sign attached to a motor vehicle which is primarily used for business purposes, other than advertising. (12/10)

H. Rotating/revolving Signs. (10/08)

I. Flashing Signs. (10/08)

J. Projecting~~Projection~~ Signs. Projecting signs exceeding 24 inches and private signs that project into or over driveways and public right-of-ways, except signs under a canopy that projects over a public sidewalk and the sign is 8 feet or more above the sidewalk. (11/05)

K. View Obstruction. Signs that obstruct required vision clearance area or obstruct a vehicle driver's view of official traffic control signs and approaching or merging traffic, or which present a traffic hazard. (5/98)

L. Safety Interference. Signs that interfere with, imitate, or resemble any official traffic control sign, signal or device, emergency lights, or appears to direct traffic, such as a beacon light. (5/98)

M. Signs in the public right of way/Use of Utility Poles. Except for government signs under Section 2.308.05(C), ~~Private~~Signs located in public right-of-way, in any public or utility easement or attached to any utility poles. Signs located in such areas are subject to immediate removal without notice.~~attached to any pole, post, utility pole or placed on its own stake and placed into the ground in the public right- of-way.~~ (5/98)

N. Vacant Land. Any sign on unimproved property, unless allowed as a temporary or portable sign. (5/98)

O. Electronic Message Signs. Electronic message signs except by conditional use permit. Electronic message signs that change more frequently than once per fifteen (15) ~~sixty (60)~~ seconds ~~minutes~~ are prohibited. Further, any change made with the use of scrolling,

flashing, fluttering or other animated effects is prohibited. Variances to any of these requirements are not allowed. (10/08)

P. Temporary or Portable signs exceeding the allowed size or timeframes for display are prohibited, unless authorized by Special Occasion Permit approval as outlined in Section 2.308.08.E.

2.308.07 Non-Commercial ~~Signs~~Uses

The following regulations apply to signs for residences, public or semi-public buildings and similar non-commercial, non-industrial uses: (5/98)

A. Sign types. The following sign types are allowed: (5/98)

1. Wall, canopy and window signs subject to the limitations in 2.308.07.C. (5/98)

2. Free-standing signs subject to the limitations in 2.308.07.C. (5/98)

3. Temporary displays consisting of any sign type for a period not to exceed 21 days in any 365 day period, however the owners or responsible parties of such displays shall be responsible for any public or private nuisance. (5/98)

B. Maximum number. Any number~~combination~~ of wall, canopy or free-standing signs not exceeding the sign area and height limitations of this Section; plus signs allowed in Section 2.308.07.A.3. (5/98)

C. Maximum Sign Area. Maximum total sign area for property on which the building or buildings are located: (5/98)

1. Single-family and two-family (duplex) dwelling: 6 square feet. (5/98)

2. Multiple family dwelling: 32 square feet. (5/98)

3. Public and semi-public: 64 square feet. (5/98)

D. Maximum sign height:

1. Wall, canopy or window sign: 8 feet. (5/98)

2. Free-standing sign: 6 feet. (5/98)

E. Location: (5/98)

1. Wall, canopy or window sign shall be set back from the property lines of the lot on which it is located, the same distance as the building containing the permitted use; provided that wall signs may project into the required setback space up to 1.5 feet. (5/98)

2. Free-standing signs are permitted where fences are allowed. (5/98)

F. Illumination. Except for Electronic Message Signs, non-commercial use signs may only be indirectly illuminated by a concealed light source, shall not remain illuminated between the hours of 11:00 p.m. and 6:00 a.m., (except by conditional use permit) and shall not flash, blink, fluctuate or produce glare. (10/2008 Ord. 2008-581)

2.308.08 Commercial and Industrial ~~Signs~~Uses

The following regulations apply to signs for commercial and industrial uses: (5/98)

A. Non-integrated Business Centers:

1. Total allowed area. One and one-half square feet of total allowed sign area for each lineal foot of building frontage, up to a maximum total allowed area of 150 square feet. (5/98)

2. On a Secondary Building Frontage, one wall sign shall be allowed, in addition to that listed above, at the rate of 0.75 sq ft per lineal foot of that portion of the building designated a Secondary Building Frontage, up to a maximum of 75 sq ft.

3~~2~~. Type, maximum number and size of signs. Within the total allowed area, one free standing sign per street frontage and an unlimited number of wall, canopy or projecting signs. Regardless of total allowed area, the free-standing signs shall be limited to a maximum of 100 square feet in area, shall not exceed one sign on each frontage, and shall be oriented to face the traffic flow on the street upon which they~~n~~ front. (5/98)

4~~3~~. Maximum sign height: (5/98)

a. Wall and canopy signs shall not project above the parapet or roof eaves. (5/98)

b. Free-standing signs: 20 feet. (5/98)

54. Location: (5/98)

a. Wall or projecting signs may project up to 2 feet away from the building. (5/98)

b. Free-standing signs have no limitations except the signs shall not project over street right-of-way and shall comply with requirements for vision clearance areas and special street setbacks. (5/98)

B. Integrated Business Centers:

1. Allowed area. For wall, canopy and projecting signs on individual businesses within an integrated business center, one and one-half square feet of total allowed sign area for each lineal foot of building frontage for the individual business, up to a total maximum of 150 square feet per business. The sign area of a projecting sign shall be calculated as a free-standing sign. Individual businesses may not assign their unused allowed area to other businesses in the integrated business center. Free standing signs are permitted only as set forth below and in Section 2.308.08.C. (11/05)

2. On a Secondary Building Frontage, one wall sign shall be allowed, in addition to that listed above, at the rate of 0.75 sq ft per lineal foot of that portion of the building designated a Secondary Building Frontage, up to a maximum of 75 sq ft. (11/05)

3. Free-standing Sign. For each integrated business center, 1 free-standing sign per street frontage not to exceed 100 square feet each in area. Free-standing signs shall not exceed one sign on each frontage and shall be oriented to face the traffic flow on the street upon which they front. (11/05)

4. Maximum sign height: (5/98)

a. Wall and canopy signs shall not project above the parapet or roof eaves. (5/98)

b. Free-standing signs: 20 feet. (5/98)

5. Location:

a. Wall or projecting signs may be located on any face of the building, except as provided in 2.308.08.B.4.b, and may project up to 2 feet away from the building. (11/05)

b. Wall signage located on a Secondary Building Frontage shall be limited to only one sign, limited in size as provided in 2.308.08.A.2. In no case may any signage derived on the primary building frontage be located on the secondary building frontage. (11/05)

c. Free-standing signs have no limitations except the signs shall not project over street right-of-way and shall comply with requirements for vision clearance areas and special street setbacks. (5/98)

C. Mixed Use Developments. Signs for developments containing a mixture of commercial and residential uses shall be subject to the following restrictions: (5/98)

1. Non-commercial uses shall be subject to the provisions in Section 2.308.07. (5/98)

2. Commercial-industrial uses shall be subject to the provisions for integrated business centers in Section 2.308.8.B. (5/98)

3. Free-standing signs shall be subject to the provisions in Section 2.308.08.B.2. (5/98)

D. Additional Signs. Within the limitations of this subsection, the signs below do not require a permit and are not included in calculating allowed area and number of signs. (5/98)

1. Secondary Entrance. When a business has two public entrances, each on a separate building wall, there is permitted one additional wall sign not to exceed 10 square feet in area for the wall where the entrance is not the primary entrance. (5/98)

2. Vehicle Directional Signs. Vehicle Directional signs~~, such as "Exit" or "Entrance",~~ are allowed either as wall or freestanding signs. Such signs shall be limited to 3 square feet in area and 2 per driveway. Free standing ~~directional~~ signs shall be limited to a height of 6 feet. (5/98)

3. ~~Menu Boards~~Drive Through Signs. ~~Order~~ Ssigns ~~describing products and/or order instructions to a customer, such as menu boards on the exterior of~~ located adjacent to a drive-through lane at a restaurant are allowed as follows: one per drive through lane ~~business~~ limited to 40 square feet in area and a maximum height of 8 feet. Any ~~order~~ sign greater than 10 square feet in

area and/or 6 feet in height must be screened from adjacent streets by a sight obscuring fence, wall or hedge. (11/05)

E. Signs for Temporary Businesses/Special Occasions.

1. Signs For Temporary Businesses. Temporary businesses receiving temporary business permit approval, may display temporary or portable signs, other than trailer mounted reader boards or any sign that includes flashing or rotating lights or moving parts. The cumulative size of all such signs may not exceed 32 square feet. All temporary business signs must be placed within 10 feet of the structure or vehicle used for the temporary business and may not be placed within any public right-of-way. (5/98)

2. Signs For Special Occasions. The placement of mulitiple and/or oversized temporary or portable signs is only allowed subject to permit approval. A Special Occasion Sign Permit may be granted for one or both of the following situations:

   ~~a.~~ Any combination of temporary or portable sign types, regardless of size and quantity, are allowed for a maximum of 14 consecutive calendar days. A maximum of 2 Special Occasion Sign permits may be issued for any given address in a calendar year, with no less than 30 days between events; ~~OR~~

   b. One oversized portable sign (not including wind feathers or feather flags) up to 16 square feet in area may be allowed for up to a 120 day period in a calendar year. Permits may be renewed and are limited to one oversized portable sign per property.

F. Signs for Mobile Food Vendors

1. In addition to the signs allowed in Section 2.308.08(F)(2) below, Mobile Food Vendors shall be limited to 6 square feet of signage which can be displayed only during hours of operation and shall comply with the provisions within Section 2.308.05.M. ~~(1) thru (5) but exempt from the time limit provision.~~ (07//17)

2. Signs painted upon or affixed directly to the Mobile Food Vendors are exempt from the Sign Code provisions, provided that no sign may protrude from or project above the roofline of the unit. All other signage must comply with the remaining provisions of Section 2.308. (07//17)

3. Property on which two or more Mobile Food Vendors are located shall comply with the remaining provisions within the Sign Code. (9/16)

G. Special Commercial Signs

1. Home Occupation. Maximum area shall be 6 square feet and subject to the location provisions in Section 2.30~~6~~8.07. (5/98)

2. Residential Sales Office. Maximum area shall be 16 square feet and subject to the location provisions in Section 2.30~~6~~8.07. (5/98)

3. Bed and Breakfast. Maximum area shall be 16 square feet and subject to the location provisions in Section 2.30~~6~~8.07. (5/98)

4. Signs for stadiums in the IBP Zone. Notwithstanding any other regulations in this Chapter, in the IBP zone for stadiums with seating for not less than 4,000 persons, the following shall apply: (11/05)

   a. Total allowed area. 760 square feet. (11/05)

   b. Type, maximum number and size of signs. Within the total allowed area, one (1) free standing sign, and a total of no more than two (2) wall or canopy signs. Regardless of the total allowed area, the free standing sign shall be limited to a maximum of 680 square feet. (11/05)

   c. Maximum sign height: (11/05)

      1. Wall and canopy signs – shall not project above the parapet or roof eaves. (11/05)

      2. Free standing sign – maximum total height of fifty (50) feet. (11/05)

   d. Location:

      1. Wall signs – may project up to 1.5 feet from the building. (11/05)

      2. Free standing sign – no limitation except shall not project over street right-of-way and shall comply with requirements for vision clearance areas and special street setbacks. (11/05)

2.308.09 Conditional Uses

A. Procedures. Applications for conditional use permits for illumination of non-commercial use signs, or electronic message signs shall be processed according to the procedure set forth in Section 3.103 of this

Ordinance. The criteria to be reviewed and applied in conditional use permit proceedings for illumination of non-commercial use signs or electronic message signs are set forth in this Section. The criteria of Section 3.103 shall not be applied. (Ord 2008-581 10/2008)

B. Decision Criteria. The following criteria shall be used to review and decide conditional use permit applications for the illumination of non-commercial use and electronic message signs: (10/2008 Ord 2008-581)

1. The proposed sign is located in an EG, P, IBP, CR, CO, MU, CM or a CG zone. (10/08)

2. The proposed sign, when conditioned, will not either: a) significantly increase or lead to street level sign clutter, or b) lead to signs that adversely dominate the visual image of the area. (10/08)

3. The proposed sign, as conditioned, will not adversely impact the surrounding area to a significant degree. Electronic Message Signs that are proposed to be located in a P zone adjacent to residential areas shall include mitigation measures such as screening and buffering or other measures to mitigate any impacts onto adjacent properties. Electronic Message Signs proposed to be located in the P zone adjacent to residential areas shall only be illuminated between the hours of 6:00 AM and 11:00 PM ~~and may only be changed once in a 24 hour period~~. (10/08)

4. The proposed sign will not present a traffic or safety hazard. (5/98)

5. If the application is for the illumination of non-commercial use or electronic message sign, no rotary beacon lights, zip lights, strobe lights, or similar devices shall be allowed. No chaser effect or other flashing effect consisting of external lights, lamps, bulbs or neon tubes are allowed. (10/08)

   Electronic Message Signs. Electronic Message signs must remain static and unchanging for a period no less than fifteen (15) ~~sixty (60) seconds~~minutes~~minutes~~. Further, the level of illumination must be limited in the following ways:

   a. (A) An electronic message sign that contains a changeable display produced by light emitting diodes, incandescent or low-voltage lamps or bulbs, or cathode ray tubes shall include automatic brightness compensation features to adjust brightness to compensate for the angle and ambient light conditions.

b. No electronic message sign may be illuminated to a degree of brightness that is greater than 7,500 nits in the daytime and 1,000 nits between sunrise and sunset; provided that electronic message signs comprised solely of one color may not be illuminated to a degree of brightness exceeding the following illumination levels:

1. For a display comprised of red only, the degree of brightness shall not be greater than 3,150 Nits in the daytime and 450 between sunrise and sunset;

2. For a display comprised of green only, the degree of brightness shall not be greater than 6,300 nits in the daytime and 900 nits between sunrise and sunset;

3. For a display comprised of amber only, the degree of brightness shall not be greater than 4,690 Nits in the daytime and 670 nits between sunrise and sunset. (10/08)

6. The total allowed sign area for a business shall be reduced by 25% if the business has an electronic message sign. (10/08)

7. The proposed sign will comply with all other regulations, including, but not limited to height and placement restrictions. (5/98)

2.308.10 Variances

A. Procedure. Any allowance for signs not complying with the standards set forth in these regulations shall be by variance. ~~Minor variances under Section 3.105.04 of this Ordinance shall not be allowed.~~ Variances to this Section will be processed according to the procedures in Section 3.202.02 as a Type I-B procedure. The criteria in Section 3.105 shall not be used, but instead the following criteria shall be used to review and decide variance applications: (11/05)

1. There are unique circumstances of conditions of the lot, building or traffic pattern such that: (5/98)

a. The existing sign regulations create an undue hardship; (5/98)

b. The requested variance is consistent with the purpose of this chapter as stated in Section 2.308.01; and

c. The granting of the variance compensates for those circumstances in a manner equitable with other property owners and is thus not a special privilege to any other

business. The variance requested shall be the minimum necessary to compensate for those conditions and achieve the purpose of this chapter. (5/98)

2. The granting of the variance shall not: (5/98)

   a. Decrease traffic safety nor detrimentally affect any other identified items of public welfare. (5/98)

   b. Result in a special advertising advantage in relation to neighboring businesses or businesses of a similar nature. The desire to match standard sign sizes (for example, chain store signs) shall not be listed or considered as a reason for a variance. (5/98)

   c. Be the result of a self-imposed condition or hardship. (5/98)

2.308.11 Exemptions

The following are exempt from the regulations of this Chapter, but may be subject to other regulations under this Development Code or other City regulations:

A. Public Art as defined by City Ordinance or Resolution. (3/14)

3.103 CONDITIONAL USE PERMITS

3.103.01 Process

Conditional Use Permit applications shall be reviewed in accordance with the Type I-B review procedures specified in Section 3.202.02. (2/01)

3.103.02 Application and Fee

An application for a Conditional Use Permit shall be filed with the City and accompanied by the appropriate fee. It shall be the applicant's responsibility to submit a complete application that addresses the review criteria of this Section. (2/01)

3.103.03 Criteria for Approval

Conditional Use Permits shall be approved if the applicant provides evidence substantiating that all the requirements of this Ordinance relative to the proposed use are satisfied, and demonstrates that the proposed use also satisfies the following criteria: (5/98)

A. The use is listed as a conditional use in the underlying district. (5/98)

B. The characteristics of the site are suitable for the proposed use considering size, shape, location, topography, and location of improvements and natural features. (5/98)

C. The proposed development is timely, considering the adequacy of transportation systems, public facilities and services, existing or planned for the area affected by the use. (5/98)

D. The proposed use will not alter the character of the surrounding area in a manner that substantially limits, impairs, or precludes the use of surrounding properties for the primary uses listed in the underlying district. (5/98)

E. The proposal satisfies any applicable goals and policies of the Comprehensive Plan which apply to the proposed use. (5/98)

3.103.04 Conditions

Upon review of those criteria, the findings may be considered to impose specific conditions of approval. The effective date of a conditional use may be limited. (2/01)

3.103.05 Transfer of a Conditional Use

Unless otherwise provided in the final decision granting this conditional use, any conditional use granted shall run with the land, and shall automatically transfer to any new owner or occupant subject to all conditions of approval. (5/98)

3.103.06 Other Conditional Use Actions

A. Signs. Pursuant to Section 2.308.09 certain types of signs require Conditional Use approval. A sign conditional use contains specific decision criteria which is found in Section 2.308.0~~9~~8. The Conditional Use request for signs is subject to a Type I-B review process with appeals to the Hearings Officer. (2/01)

B. Floodplain Development Permit. Pursuant to Section 2.122.06 certain types of floodplain development requires Conditional Use approval. A floodplain conditional use contains specific decision criteria which is found in Section 2.122.06. The Conditional Use request is subject to a Type I-B review process with appeals to the Hearings Officer. (2/01)

C. Greenway Development Permit. Pursuant to Section 2.121.04 certain types of Greenway activities require Conditional Use approval. A Greenway conditional use contains specific decision criteria which is found in Section 2.121.04. The Conditional Use requests are subject to a Type I-B review process with appeals to the Hearings Officer. (2/01)

KEIZER PLANNING COMMISSION
MEETING MINUTES
Wednesday, March 14, 2018 @ 6:00 pm
Keizer Civic Center

CALL TO ORDER
Chair Hersch Sangster called the meeting to order at 6:04 pm.

ROLL CALL:

Present:
Hersch Sangster, Chair
Kyle Juran, Vice Chair
Josh Eggleston
Garry Whalen
Crystal Wilson
Matt Lawyer
Isaac Matthews, Youth Liaison

Absent:
Michael DeBlasi

Council Liaison:
Kim Freeman

Staff Present:
Nate Brown, Community Development Director
Shannon Johnson, City Attorney
Shane Witham, Senior Planner

APPROVAL OF MINUTES: Commissioner Lawyer moved for approval of the February 2018 Minutes. Commissioner Juran seconded. Motion passed as follows: Sangster, Juran, Eggleston, Wilson, Lawyer and Whalen in favor with DeBlasi absent.

APPEARANCE OF INTERESTED CITIZENS: None

PUBLIC HEARING: Text Amendment Case No. 2017-16, Section 2.308 (Signs) to clarify the requirements governing signs.

Chair Sangster opened the public hearing.

Senior Planner Shane Witham reviewed the process that this issue has undergone and brought attention to an email received from Commissioner DeBlasi and Beth Teske of Jersey Mike's. He reviewed the information and table in his most recent staff report and explained how different decisions were made and the difference between the Salem and Keizer sign codes.

Jonathan Thompson, Government Affairs Committee Chair for the Keizer Chamber of Commerce, voiced appreciation for the simpler Sign Code and the way election signs are being treated. He expressed concern over the message intervals proposed for electronic message centers and the window sign requirements and requested 8-second intervals and no restrictions on signs in windows.

Lengthy discussion followed regarding window sign coverage, electronic message center intervals, use of opaque glass for privacy rather than advertising, attracting businesses, election timeframes, grandfather clauses, glazing vs. glass, code enforcement, distracted driving and brightness measurements.

Community Development Director Nate Brown showed a video which showed what River Road would look like with electronic message intervals of 8 seconds and noted that it was likely that as technology becomes more affordable even more businesses would be utilizing this type of sign. He urged Commissioners to consider what they wanted their community to look like and the aesthetics of the community's main thoroughfare.

Commissioner Juran expressed the opinion that River Road is a commercial core and businesses should be given a free reign to draw people in.

Commissioner Lawyer suggested that verbiage related to elections be clarified. Mr. Johnson indicated that since the current language is 'governmental elections' the intent is that it is a recognized governmental election and more detail is probably unnecessary but he would consider inserting clarification of perhaps 'up to 4 times a year'.

Commissioner Wilson suggested that the frequency of Grand Opening/Special Occasion signs be clarified to be 2 times a year to which Mr. Johnson agreed.

With no further testimony, Chair Sangster closed the Public Hearing.

Commissioner Juran moved to delete the rest of the phrase starting with 'provided' on page 10, Section 2.308.05 Signs Generally Permitted, subsection I, Window Signs. Commissioner Lawyer seconded. Motion passed as follows: Sangster, Juran, Eggleston, Wilson, Lawyer and Whalen in favor with DeBlasi absent.

Commissioner Juran moved to change the interval on electronic messaging centers to 8 seconds. Commissioner Whalen seconded. Motion failed as follows: Juran, Whalen and Lawyer in favor with Wilson, Eggleston and Sangster opposed with DeBlasi absent.

Commissioner Lawyer moved to change the interval on electronic messaging centers to 15 seconds. Commissioner Eggleston seconded. Motion passed as follows: Sangster, Eggleston, Wilson, and Lawyer in favor with Whalen and Juran opposed and DeBlasi absent.

Commissioner Whalen moved that the Planning Commission recommend that Council accept staff's recommendation on the Sign Code Section 3.208 text amendment with Commission changes. Commissioner Juran seconded. Chair Sangster clarified that the corrections were relating to signs in the windows, 15 second electronic messaging intervals, clarification of the Grand Opening/Special Occasion sign allowance and using Salem brightness standards as a guide. Motion passed as follows: Sangster, Juran, Eggleston, Wilson, Lawyer and Whalen in favor with DeBlasi absent.

NEW/OLD BUSINESS/STAFF REPORT: Mr. Brown reported that the Revitalization Project is in full swing. It will be different than the Cost of Growth interviews. Staff will be asking for Planning Commission participation in public meetings. Interviews are being scheduled specifically with business owners. These will take place over a two-day period. Participants will be given the questions prior to their interview. The public workshop will be in April. Commissioners agreed that

the Public Workshop should take the place of the April meeting. Mr. Brown added that at the May meeting the Commission will address updating the ordinance relating to the Historic Structure Zone to adequately reflect statutory requirements.

Commissioner Lawyer reminded everyone of the Civic Center cleanup.

COUNCIL LIAISON REPORT: Councilor Freeman announced that she would be the new liaison for the Planning Commission. She reported on the Long Range Planning Task Force and announced upcoming Budget Committee meeting dates.

YOUTH COMMITTEE LIAISON REPORT: Youth Liaison Matthews had no report.

COUNCIL REPRESENTATIVE: Commissioner Sangster will report at the March 19 Council meeting.

ADJOURN: The meeting adjourned at 8:13 pm.

Next Meetings
Public Workshop: April 26, 2018
Regular Session: May 9, 2018

Minutes approved: 05-09-18

KEIZER PLANNING COMMISSION
MEETING MINUTES
Wednesday, September 13, 2017 @ 6:00 pm
Keizer Civic Center

CALL TO ORDER
Chair Hersch Sangster called the meeting to order at 6:00 pm.

ROLL CALL:

Present:
Hersch Sangster, Chair
Kyle Juran, Vice Chair
Josh Eggleston
Michael DeBlasi
Jim Jacks (6:07)
Garry Whalen

Absent:
Jerry Crane – resigned

Council Liaison:
Marlene Parsons

Staff Present:
Nate Brown, Community Development Director
Shane Witham, Associate Planner
Shannon Johnson, City Attorney

APPROVAL OF MINUTES: Commissioner Josh Eggleston moved for approval of the August 2017 Regular Session Minutes. Commissioner Juran seconded. Motion passed as follows: Sangster, Juran, DeBlasi, Whalen and Eggleston in favor with Jacks absent at time of vote and one position vacant.

APPEARANCE OF INTERESTED CITIZENS: None

PUBLIC HEARING: Section 2.308 – Signs

Chair Sangster re-opened the Public Hearing.

Community Development Director Nate Brown brought attention to the table attached to his staff report and urged Commission to provide direction on all eight items.

Jonathan Thompson, Keizer, representing the Keizer Chamber summarized his testimony from the August meeting noting that the Chamber agreed with most of what is being proposed but would like the electronic sign frequency changed to 8 second intervals. He pointed out examples of businesses with reader boards noting that while driving they are not visible to a driver for more than 8 seconds. He also noted that if the message is allowed to change more frequently, businesses are more likely to insert public service announcements. Speaking as an individual he noted that the regulation of election signs is complicated but he supported the staff recommendation of allowing more signage on a temporary basis.

Carlos Soto, Keizer, River Road business owner, urged that electronic sign frequency be changed to 8 seconds noting that studies show that limiting the

frequency to less than that directly impacts the vitality of the community and the health of businesses.

Jane Lowery, Keizer, Branch Manager at Willamette Valley Bank, also urged that the frequency of signs be changed to 8 seconds so that more community based messages could be displayed without limiting business related signage.

Carlos Pineda, Keizer, owner of El Patron Mexican Grill and Chamber Board of Directors member, also urged that the frequency of signs be changed to 8 seconds.

Senior Planner Shane Witham then went through the table with the Commission.

Following lengthy discussion the following recommendations were made:

Amortization/Non-Conforming Language	Defer to Legal Department
Election Signs	Allow unlimited portable signs during election timeframe
Real Estate Signs	Work with Legal to eliminate the words 'real estate'
Window Signs	No Change (50%)
Portable/Temporary Signs	Maintain existing language (25 feet between each)
Electronic Message Signs	Stay with staff recommendation of 60 second intervals
Secondary Frontage	Allow in non-integrated business centers
Grand Opening	Accept staff recommendation

With no further testimony Chair Sangster closed the public hearing.

City Attorney Shannon Johnson noted that at this point there was no need for a motion since the Commission had provided adequate direction to staff.

NEW/OLD BUSINESS/STAFF REPORT: Mr. Brown reported that the City had signed the agreement for the Education Outreach Grant. This effort will primarily involve staff working with the consultant to prepare for a joint work session with Planning Commission, Council and invited stakeholders focusing on how other communities have dealt with limited land supply for their growth.

An Intergovernmental Agreement is very close on the Keizer Revitalization Plan Grant. This would involve exploring options for: increasing flexibility, multi-use approaches and opportunities for growth in commercial areas.

COUNCIL LIAISON REPORT: Councilor Parsons reviewed recent Solar Eclipse events at Keizer Rapids Park.

COUNCIL REPRESENTATIVE: Commissioner Jacks volunteered to report at the September 18 Council meeting.

ADJOURN: The meeting adjourned at 8:36 pm.

Next Meeting: October 11, 2017

Minutes approved: 11-08-17

KEIZER PLANNING COMMISSION
MEETING MINUTES
Wednesday, August 9, 2017 @ 6:00 pm
Keizer Civic Center

CALL TO ORDER
Chair Hersch Sangster called the meeting to order at 6:00 pm.

ROLL CALL:

Present:
Hersch Sangster, Chair
Kyle Juran, Vice Chair
Josh Eggleston
Michael DeBlasi
Jim Jacks
Garry Whalen

Absent:
Jerry Crane

Council Liaison:
Marlene Parsons

Staff Present:
Nate Brown, Community Development Director
Shane Witham, Associate Planner
Shannon Johnson, City Attorney

APPROVAL OF MINUTES: Commissioner Jacks moved for approval of the July 2017 Regular Session Minutes. Commissioner DeBlasi seconded. Motion passed as follows: Sangster, Juran, Jacks, DeBlasi, Whalen and Eggleston in favor with Crane absent.

APPEARANCE OF INTERESTED CITIZENS: None

PUBLIC HEARING: Section 2.308 – Signs

Chair Sangster opened the Public Hearing.

Community Development Director Nate Brown explained that the changes are due in part to the Supreme Court decision in Reed vs. Gilbert which requires all sign codes to be content neutral. Staff has gone through the Code to identify anything in opposition to that instruction. He explained that the Sign Code is complex and ingrained in the business community. Every adjustment has ramifications, but the main objective of any Sign Code is identification of place, balanced visual access to the public, fairness and equity, and uniform enforcement. What is proposed preserves the goals, ideals, aesthetic standards, fairness to businesses and enforceability.

Senior Planner Shane Witham noted that staff feels the Keizer Sign Code is not 'broken' but is aware of the struggles of equitable enforcement. He pointed out the bullet points in his staff report and noted that there are parts of the Sign Code that do not make sense because it was adopted before the Development Code. He cautioned the Commission about loosening something with the idea of coming back to tighten it up later because once regulations are loosened it is difficult to go back again.

Mr. Brown and Mr. Witham then spent considerable time explaining various aspects of the changes including portable signs, feather signs, temporary signs, real estate signs, electronic message signs and methods for tracking how long a sign is on display.

Jonathan Thompson, Keizer, speaking for the Chamber Board, voiced general support for the changes and asked that signs be required to be unbroken and clean, sign requirements be kept simple and fees kept low, and that the length of time for electronic message signs be dropped from 15 minute intervals to the national standard of 8 seconds. This would make it easier for businesses to incorporate public service messages into their business messages.

Justin Briley, owner of Keizer Mart, explained that his business has unique challenges because of trees that block the signage and sharing sign space with other businesses in the complex. Mr. Witham explained the changes that would be beneficial to Mr. Briley's business. Mr. Brown added that the landlord has promised to have a dialog with him to address these difficulties.

Discussion followed regarding geometric figures, electronic message signs, non-conforming signs, amortization, abandoned signs, development signs, window signs, secondary building wall signage, vehicle directional signs vs. incidental signs, elections signs and measurement of lighting. Mr. Brown pointed out that one of the proposed amendments is to shorten the message board change frequency from 15 minutes to 60 seconds. Commissioner Juran noted that Keizer is a small community with a small business district and he was not in favor of mimicking Salem with an 8 second change time on electronic message boards.

Bob Shackelford, incoming president of the Keizer Chamber of Commerce, explained that many signs look like they are filling a window but they are actually mesh sunshades. He expressed a pet peeve about shrubs and trees and suggested that some trimming be done.

Chair Sangster continued the public hearing to the September meeting.

NEW/OLD BUSINESS/STAFF REPORT: Mr. Brown reported that there is a lot of activity in Area A of Keizer Station. Permits have been pulled for Café Yum and Hop Jacks Brew Pub. The hotel is out of the ground and with workers working diligently. Discussions are underway with the property owner adjacent to Keizer Permanente to do another building. Work continues with the proponent of a theater at Area B. He added that the City still does not have a contract for the Transportation and Growth Management Grant consultant which gives him concern on how long it will take to accomplish anything. The plan is to look at the overlay zone and explore its effectiveness as well as to look at the entire corridor and explore how to incorporate more mixed use development and make better use space.

COUNCIL LIAISON REPORT: Councilor Parsons reported that Council had given approval for Safeway to build a 425 square foot building in conjunction with a fueling station, and approved the $4 parks and public services fees, Keizer Station Area B amendment, the parking amendment in the Development Code and the

change of operation times for marijuana retail facilities. She reminded everyone of the upcoming eclipse event, noted that smoking will be allowed only in paved areas and vehicles in parks, and reviewed the concert schedule at Keizer Rapids Park for that weekend.

COUNCIL REPRESENTATIVE: Commissioner Eggleston was unable to report to Council. Since no action was taken at this meeting Mr. Brown volunteered to report to Council.

ADJOURN: The meeting adjourned at 8:00 pm.

Next Meeting: September 13, 2017

Minutes approved: 9-13-17

KEIZER CHAMBER of COMMERCE

Danielle Bethell <danielle@irisfestival.com>

Re: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

1 message

Dustin Karstetter <dustin@keizersoccerclub.org> Thu, Jul 27, 2017 at 10:09 PM
To: Danielle Bethell <danielle@keizerchamber.com>

Danielle,

In response to the email you sent out, I wanted to respond on behalf of Keizer Soccer, and in a larger capacity, for other non-profit youth sports organizations.

I didn't see anything specific in your email indicating a restriction on temporary signs for non-profit organizations, but after reviewing the current sign code for the City of Keizer, I see that there are several limits placed on such signage, such as only being allowed three signs at one time and that they can only be up for 5 days at a time.

I know that our organization, along with several of the other sports organizations in town have broken these guidelines in the lead up to our seasons, as it is necessary to advertise registration in a public way, and signs are generally the easiest and most effective way to get the word out about registration in the weeks leading up to each season.

I would ask for a revision to the current code which allows for a subset of temporary signs specifically for youth sports organizations, allowing us to have multiple signs around the City of Keizer for up to one month prior to the close of registration, to ensure that each club or organization has ample time to advertise for securing necessary numbers to allow for growth and a quality experience for all participants.

It is my hope that the future sign code can change with the needs of these specific organizations to effectively advertise to us customer base and potential new members.

Thanks,
Dustin Karstetter
KSC Board President

On Thu, Jul 27, 2017 at 10:11 AM, Danielle Bethell <danielle@keizerchamber.com> wrote:

> Dear Keizer Chamber Members,
>
> At the request of the City of Keizer, we met with members of the team in Community Development to discuss changes they are proposing to the sign code dealing with temporary and electronic signs. We wanted to update you on these discussions and request your feedback.
>
> First, the proposal eliminates many of the categories of signs and puts them under one umbrella based on size. The city as a government agency cannot regulate content. Under the proposed rules, each business would be allowed one temporary sign (like a sidewalk A-frame sign or flag). This is a change as it would allow each business in a multi-business center to have a temporary sign. The sign would need to be less than eight square feet. There would be no requirement for separation of the signs. That would be up to the property owners.
>
> Sign placement would still need to comply with other regulations like the Americans with Disabilities Act in that they could not block a sidewalk for example.
>
> Temporary signs larger than eight square feet would be broken into two groups based on size and would require a permit from the city. These signs could be up for no more than 120 days.

KEIZER CHAMBER of COMMERCE

Danielle Bethell <danielle@irisfestival.com>

RE: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

1 message

Susan Dunfee <susan.dunfee@academymortgage.com> Thu, Jul 27, 2017 at 3:55 PM
To: Danielle Bethell <danielle@keizerchamber.com>

I like the proposal as I read and understood it. J

Susan Dunfee

Loan Officer | NMLS # 1122681

(503) 391-7194 - Branch

(866) 264-5745 - Fax

(503) 799-7205 - Mobile

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KEIZER CHAMBER of COMMERCE

Danielle Bethell <danielle@irisfestival.com>

RE: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

Jeff Cowan <chief@keizerfire.com> Thu, Jul 27, 2017 at 11:17 AM
To: Danielle Bethell <danielle@keizerchamber.com>

I don't understand why the deadline is tomorrow? What is driving that?

One Day is not enough time to review sign code on this very complex issue. This document is 19 pages.

I do support the change to allow electronic boards to change more frequently. We consider our Fire District Electronic Reader Board a community information board.

We would put more on it if this was allowed.

Chief Cowan

From: Danielle Bethell [mailto:danielle@keizerchamber.com]
Sent: Thursday, July 27, 2017 10:11 AM
To: Jeff Cowan
Subject: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

Dear Keizer Chamber Members,

At the request of the City of Keizer, we met with members of the team in Community Development to discuss changes they are proposing to the sign code dealing with temporary and electronic signs. We wanted to update you on these discussions and request your feedback.

First, the proposal eliminates many of the categories of signs and puts them under one umbrella based on size. The city as a government agency cannot regulate content. Under the proposed rules, each business would be allowed one temporary sign (like a sidewalk A-frame sign or flag). This is a change as it would allow each business in a multi-business center to have a temporary sign. The sign would need to be less than eight square feet. There would be no requirement for separation of the signs. That would be up to the property owners.

Sign placement would still need to comply with other regulations like the Americans with Disabilities Act in that they could not block a sidewalk for example.

Temporary signs larger than eight square feet would be broken into two groups based on size and would require a permit from the city. These signs could be up for no more than 120 days.

Signs between eight and 16 square feet could not be divided. However, those 16 square feet and larger could be. For example, if based the current ordinance you could have a sign that is a total of 50 square feet, you could break that up

KEIZER CHAMBER of COMMERCE

Danielle Bethell <danielle@irisfestival.com>

Re: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

TONY GROVE, TONYS KINGDOM OF COMICS <sirwag@comcast.net> Thu, Jul 27, 2017 at 11:25 AM
To: Danielle Bethell <danielle@keizerchamber.com>

This all sounds reasonable to me. Hopefully the "sidewalk" signs will also be required to be professional, clean and in good state of repair.....Tony

TONY GROVE
TONY'S KINGDOM OF COMICS
3856 RIVER RD N
KEIZER OR 97303
503-463-1142
WEBSITE: http://www.tonyskingdom.net/
FACEBOOK SHOP PAGE: https://www.facebook.com/TonysKingdom/?ref=hl

----- Original Message -----
From: Danielle Bethell <danielle@keizerchamber.com>
To: sirwag@comcast.net
Sent: Thu, 27 Jul 2017 17:11:37 -0000 (UTC)
Subject: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

Dear Keizer Chamber Members,

At the request of the City of Keizer, we met with members of the team in Community Development to discuss changes they are proposing to the sign code dealing with temporary and electronic signs. We wanted to update you on these discussions and request your feedback.

First, the proposal eliminates many of the categories of signs and puts them under one umbrella based on size. The city as a government agency cannot regulate content. Under the proposed rules, each business would be allowed one temporary sign (like a sidewalk A-frame sign or flag). This is a change as it would allow each business in a multi-business center to have a temporary sign. The sign would need to be less than eight square feet. There would be no requirement for separation of the signs. That would be up to the property owners.

Sign placement would still need to comply with other regulations like the Americans with Disabilities Act in that they could not block a sidewalk for example.

Temporary signs larger than eight square feet would be broken into two groups based on size and would require a permit from the city. These signs could be up for no more than 120 days.

Signs between eight and 16 square feet could not be divided. However, those 16 square feet and larger could be. For example, if based the current ordinance you could have a sign that is a total of 50 square feet, you could break that up into five signs that are 10 square feet.

KEIZER CHAMBER of COMMERCE

Danielle Bethell <danielle@irisfestival.com>

RE: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

Jeff Baker <drbaker@wvi.com> Thu, Jul 27, 2017 at 10:28 AM
To: Danielle Bethell <danielle@keizerchamber.com>

Danielle Bethell –

This is Dr. Baker of BACK to Health Clinic on River Rd by the Taco Bell. I am in support of the proposed changes suggested for the provisions governing the rate of change for electronic signs. I am support of electronic signs, they are becoming the standard and having a message change at a frequency of 8sec to 30 seconds is acceptable. 15 minutes is not realistic for most businesses like mine who have many messages to convey. This does not pose a hazard to traffic, in my opinion and experience in treating thousands of car crash cases over the years. I have not once had a patient come in from a car accident related to a distraction from reading a changing electronic sign.

Thank you for the opportunity to voice my support for the changes proposed for the Keizer Sign Code.

Jeffery W. Baker DC, PC

Clinic Director – BACK to Health Clinic

503-304-2225 | 503-304-2226 fax | DrBaker@wvi.com

www.SalemBackDoctor.com

KEIZER CHAMBER of COMMERCE

Danielle Bethell <danielle@irisfestival.com>

RE: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

Richard Cummings <richard@911supply.com> Thu, Jul 27, 2017 at 10:24 AM
To: Danielle Bethell <danielle@keizerchamber.com>

Hi Danielle,

Thank you for the detailed updates.

I don't have much of an opinion on the electronic signs but it makes sense to relax the rules a bit similar to Salem's rules.

As far as everything else goes as long as they keep it *simple* and easy for businesses to comply while NOT charging unnecessary fees then I'm all for it.

Did I mention they should keep the rules simple?? J

Thank you!

Richard Cummings

911 Supply Inc.

4484 River Rd N

Keizer, OR 97303

Ph. 503-393-4911

Fax 503-393-2107

www.911supply.com

From: Danielle Bethell [mailto:danielle@keizerchamber.com]
Sent: Thursday, July 27, 2017 10:12 AM
To: Richard Cummings <richard@911supply.com>

KEIZER CHAMBER of COMMERCE

Danielle Bethell <danielle@irisfestival.com>

Re: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

Rich Ford <richford@windermere.com> Thu, Jul 27, 2017 at 10:22 AM
To: Danielle Bethell <danielle@keizerchamber.com>

I don't see the proliferation of sandwich board type signs as a positive development for our community. They give a cluttered look to the environment, and as a consumer, I do not find them useful or helpful. Unless there is some special, temporary event, I would like to see them eliminated altogether.

Rich

Rich Ford, Licensed Oregon Real Estate Broker
Windermere Pacific West Properties, Inc.
4285 Commercial Street SE, Suite 100
Salem, Oregon 97302
Cell: (503) 510-9583 Office: (503) 391-1350
Email: RichFord@Windermere.com
Website: www.RichFord.withWRE.com

From: Danielle Bethell <danielle@keizerchamber.com>
Sent: Thursday, July 27, 2017 10:11:19 AM
To: Rich Ford
Subject: Keizer Sign Code: Changes Coming: YOUR FEEDBACK NEEDED!

Dear Keizer Chamber Members,

At the request of the City of Keizer, we met with members of the team in Community Development to discuss changes they are proposing to the sign code dealing with temporary and electronic signs. We wanted to update you on these discussions and request your feedback.

First, the proposal eliminates many of the categories of signs and puts them under one umbrella based on size. The city as a government agency cannot regulate content. Under the proposed rules, each business would be allowed one temporary sign (like a sidewalk A-frame sign or flag). This is a change as it would allow each business in a multi-business center to have a temporary sign. The sign would need to be less than eight square feet. There would be no requirement for separation of the signs. That would be up to the property owners.

Sign placement would still need to comply with other regulations like the Americans with Disabilities Act in that they could not block a sidewalk for example.

Temporary signs larger than eight square feet would be broken into two groups based on size and would require a permit from the city. These signs could be up for no more than 120 days.

KEIZER CHAMBER of COMMERCE

Danielle Bethell <danielle@irisfestival.com>

Flags

1 message

KZR Executive Director <ExecutiveDirectorKZR@livebsl.com> Mon, Jul 24, 2017 at 1:24 PM

To: Danielle Bethell <danielle@keizerchamber.com>

Good Morning,

In response to your request for more information regarding our run in with the city in relation to our feather flags.

On or around the 18thth of May I had 10 Large Green Feather Flags installed all along Chemawa Road on our property line in our landscaping by my Maintenance Man. They were brand new in great condition.

On the 28th of May (a Sunday afternoon) I received an email from Dina Russell with the city regarding a temporary sign and the city codes surround them. I was surprised as I have operated in Salem for years at our South Salem property with not a word about signs or code enforcement. On the 30th I requested a meeting for my boss Jeremiah Gray to be a part of in our building. Dina responded and said that she would be having Ben join us as the code enforcement officer.

We had a great meeting I thought, They stated that they get harassed by the repair guy that you mentioned in our meeting that had so much trouble with his signs and the new parking lot (his name escapes my memory) and that they want it to be fair for everyone. We agreed and said you know we are sorry because we had our grand opening coming up and that we would be happy to take them down. We even offered to pay the fee to leave them up the short amount of time that we had planned to do it. They declined and said that we would have to follow the code enforcement process. They also brought up our Balloon and A-Board signs that are out on the corner of our driveway and the corner of our landmark sign.

A week after our grandopening we took down the feather flags but continue to leave out our balloons and A-Board signs during business hours.

In all honesty, it seemed odd that we have had balloons and A-Boards at the street for the last year and a Large red Banner on our building and trailer all during construction. Then when we were finally open that we are not allowed to have any of our signage. We also made sure that they are brand new and in great shape prior to putting them up and out there. It was also extremely odd to me to be getting notified about it on a Sunday not from the code enforcement person.

I also took the liberty of driving to the bank down river road from Lockhaven one day in July and noticed the

Jersey Mikes still has a feather flag out, The Arbor at Avamere court had two feather flags out at the street and an A-Board (we were told that you are only allowed one type of sign at a time), and as you progress down river road towards Salem they are every other block if not more frequent. It felt very odd as a new business, almost as if we were targeted. I don't like saying that and I don't like feeling that well but that is a little of how it felt.

I finally received an additional email on July 3rd regarding our A-Board not coming in at night. I cannot find in any of the codes an actual time that they have to be taken in. Since our business doesn't close it is hard to assign a time to it.... We were also told we aren't allowed to have the all weather balloons in the same email. Dina also referenced that even though they are popping up all over town it wasn't allowed and they are doing their best to tell the others as well.

Im happy to help please just let us know how we can help further the conversation.

Thank you,

McKenzie Owens

Bonaventure At Keizer Station

RetirementPerfected.com

5525 McLeod Lane NE Keizer,OR 97303

W: 503 -689-8084 F: 503-689-8078

Executivedirectorkzr@livebsl.com

"True Leaders understand that leadership is not about them but about those they serve. It is not about exalting themselves but about lifting others." Sheri L. Dew

Witham, Shane

From: James Carpentier <James.Carpentier@signs.org>
Sent: Monday, July 31, 2017 12:29 PM
To: Witham, Shane
Cc: Patti King; David Hickey; Corey Spady
Subject: RE: sign code update
Attachments: NWSC ISA comments existing Keizer Sign Code 7-31-17.pdf; Texas A & M Traffic Safety & EMCs.pdf; ISA 2014 Analysis of FHWA Study of CEVMS2.pdf; cevmsfinal.pdf; EVOS_final_v3_js.pdf

Hello Mr. Witham,

On behalf of the Northwest Sign Council and International Sign Association, I did take a look at your existing code and have a number of comments and recommendations for your consideration. We have a number of recommendations for your consideration including:

- A number of references to content which may not comply with Reed v. Town of Gilbert.
- The total allowable sign area at 1.5 of building frontage for both wall and ground signs is not reasonable. This type of standard will work well for wall signs only with a separate standard for ground signs. This regulation will lead to some signs that will not be safely viewed by the intended viewer. Narrow vs wide buildings will have a huge disparity in allowable signage. A standard with this approach needs to include the parcel frontage rather than building frontage (this standard 1.5 will work ok in a downtown that has buildings adjacent to the ROW where ground signs are not feasible) and be increased to at least 2 sq. ft per linear ft. with reasonable caps on ground and wall signs.
- A number of issues with the electronic message center standards. The hold time at 15 minutes or 24 hours is not reasonable or based on any recent safety studies (see attached Texas A & M study and FHWA study along with ISA's analysis). The Texas A & M study indicates the following on page viii: "The results of this study provide scientifically based data that indicate that the installation of digital on-premise signs does not lead to a statistically significant increase in crashes on major roads." The illumination standards are not based on the most current recommendations which utilizes the Footcandle approach. This method is much easier to enforce than nits. In addition this approach has been adopted by over 250 jurisdictions and states with no known issues. The footcandle approach is about three times less bright than the existing nits standard of 1,000. Also, the reduction of 25% in sign area if EMCs are utilized is an atypical regulation and is a huge disincentive to utilize this very effective technology. See the attached case study in the Economic Value of Signs by the University of Cincinnati on page 39.

Do not hesitate to contact me with any questions or if you need any information.

James B Carpentier AICP
Director State & Local Government Affairs

1001 N. Fairfax Street, Suite 301
Alexandria, VA 22314
(480) 773-3756 Cell
www.signs.org | www.signexpo.org
james.carpentier@signs.org

2.308 SIGNS

2.308.01 Purpose

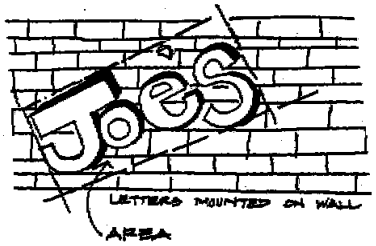
The purpose of these sign regulations is to provide equitable signage rights, reduce signage conflicts, promote traffic and pedestrian safety, and, increase the aesthetic value and economic viability of the city, all by classifying and regulating the location, size, type and number of signs and related matters, in a content-neutral manner. (5/98)

2.308.02 Definitions

For the purposes of this Chapter, the following definitions shall apply: (5/98)

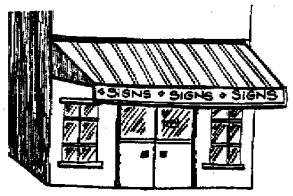
Alteration or Altered: Any change in the size, shape, method of illumination, position, location, construction, or supporting structure of a sign. A change in sign copy or sign face alone shall not be considered an alteration. (5/98)

Area: The area of a sign shall be the entire area within any type of perimeter or border which encloses the outer limits of any writing, representation, emblem, figure, or character. If the sign is enclosed in a frame or cabinet the area is based on the inner dimensions of the frame or cabinet surrounding the sign face. When a sign is on a base material and attached without a frame, such as a wood board or Plexiglas panel, the dimensions of the base material are to be used. The area of a sign having no such perimeter, border, or base material shall be computed by enclosing the entire area within a parallelogram or a triangle of the smallest size sufficient to cover the entire message of the sign and computing the area of the parallelogram or a triangle. For the purpose of computing the number of signs, all writing included within such a border shall be considered one sign, except for multi-faced signs on a single sign structure, which shall be counted as one sign per structure. The area of multi-faced signs shall be calculated by including only one-half the total area of all sign faces. (5/98)



Sign Area

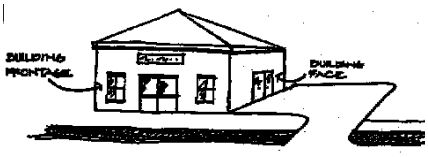
Awning: A shelter supported entirely from the exterior wall of a building and composed of non-rigid materials, except for the supporting framework. (5/98)



Awning Sign

Building Face: The single wall surface of a building facing a given direction. (5/98)

Building Frontage, Primary: The portion of a building face most closely in alignment with an adjacent right-of-way or fronting a parking lot when so defined, as allowed in this chapter. A gasoline service station may use the overhanging canopy as a substitute for building frontage when computing the allowable sign area. The longest side of the canopy shall be used to compute the allowable sign area. (Ord. 2005-533 11/05)



Building Frontage and Face

Building Frontage, Secondary: Buildings located on lots abutting more than one Right of Way or a parking lot may designate one building face as a secondary building frontage. (Ord. 2005-533 11/05)

Canopy Sign: A sign hanging from a canopy or eve, at any angle relative to the adjacent wall, the lowest portion of which is at least eight (8) feet above the underlying grade. (5/98)

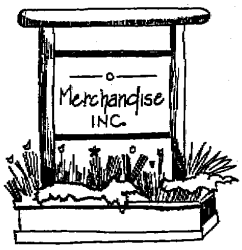
Canopy Sign

Construct: Build, erect, attach, hang, place, suspend, paint in new or different word, affix, or otherwise bring into being. (5/98)

Election Signs: Those signs which relate to an election, initiative or political viewpoint. Such signs will otherwise meet the specifications of Temporary Signs. (5/04 – Ord 2004-498)

Electronic Message Sign: Signs that incorporate as part of, or wholly, an electronic message or display by means of light emitting diodes, plasma, electronic ink, or other means that allow that display to be changed through electronic controls. Further, an electronic message sign cannot be a wall sign. (10/08 – Ord 2008-581)

Finish Ground Level: The average elevation of the ground (excluding mounds or berms, etc. located only in the immediate area of the sign) adjoining the structure or building upon which the sign is erected, or the curb height of the closest street, which ever is the lowest. (5/98)

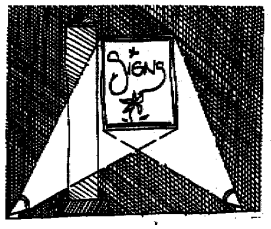


Free-Standing Sign

Flashing Sign: A sign any part of which pulsates, scrolls, flutters, animates, lights intermittently, or blinks on and off. (10/08)

Free-Standing Sign: A sign supported by one or more uprights, poles or braces placed in or upon the ground, or a sign supported by any structure primarily for the display and support of the sign. (5/98)

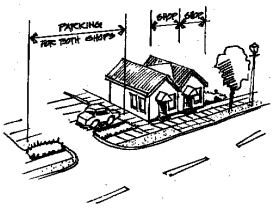
Incidental Signs: A sign that is normally incidental to the allowed use of the property, but can contain any message or content. Such signs can be used for, but are not limited to, nameplate signs, warning or prohibition signs, and directional signs not otherwise allowed. (5/98)



Indirect Illumination

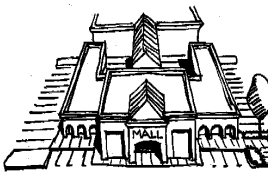
Indirect Illumination: A source of illumination directed toward such sign so that the beam of light falls upon the exterior surface of the sign. (5/98)

Integrated Business Center: A group of two or more businesses which are planned or designed as a center, and share a common off-street parking area or access, whether or not the businesses, buildings or land are under common ownership. (5/98)


Small Integrated Business Center

Internal Illumination. A source of illumination from within a sign. (5/98)

Joint Use Sign: When two of more businesses combine part or all of their total allowed sign area into free-standing sign for each common frontage of such business. (5/98)



Large Integrated Business Center

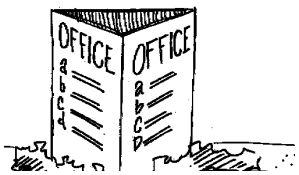
Multi-faced Sign: A sign which has two or more identical sign faces, contained in a single sign structure. (5/98)

Multi-family Dwelling: A residential structure or complex of structures that include three or more separate dwelling units, whether rented or owned by the occupants. (5/98)

Joint-Use Sign

Mural: An illustration (with or without words or numbers) which is painted or otherwise applied (without projections) to an outside wall of a structure. (5/98)

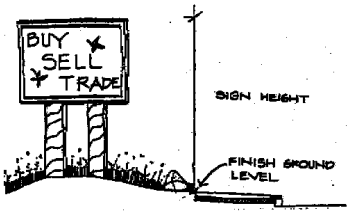
Nit: Nit is used as a measurement of luminance, where the Nit is equal to one candela per square meter (1cd/m2). A candela is a unit of measurement of the intensity of light, where one candela is the monochromatic radiation of 540THz with a radiant intensity of 1/683 watt per steradian in the same direction. By way of example, an ordinary wax candle generates approximately one candela. (10/08)



– Portable Signs

Nonconforming Sign: Any sign which lawfully exists prior to the effective date of this chapter but, which due to the requirements adopted herein, no longer complies with the height, area and placement regulations or other provisions of these regulations. (5/98)

Owner: As used in these regulations, "owner" means owner or lessee of the sign. If the owner or lessee of the sign cannot be determined, then "owner" means owner or purchaser of the land on which the sign is placed. (5/98)



Sign Height

Portable Sign: A sign that is, or similar to, an A-frame sign, sandwich board sign, or a sign attached to wood or metal frames and designed to be self supporting and movable. Portable signs are not to be considered temporary signs as defined and used in this chapter. (12/10)

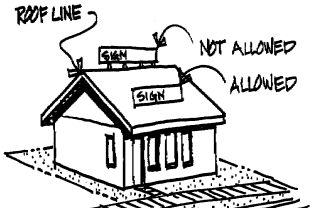
Projecting Sign

Projecting Signs: A sign the face of which is not parallel to the wall on which it is mounted. (11/05)

Real Estate Sign: A sign for the purpose of rent, lease, sale, etc. of real property, building opportunities, or building space. (5/98)

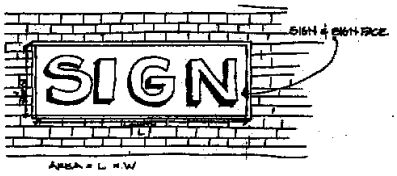
Roof Line: Either the eaves of the roof or the top of the parapet, at the exterior wall. (A "mansard roof" is below the top of a parapet and is considered a wall for sign purposes.)

Roof Sign: A sign or any portion of which is displayed above the highest point of the roof, whether or not such sign also is a wall sign. (5/98)



Rotating/Revolving Sign: A sign, all or a portion of which, moves in some manner. (5/98)

Sign: Any writing, including letter, word, or numeral; pictorial presentation, including mural, illustration or decoration; emblem, including device, symbol or trademark; flag, including banner or pennant; or any other device, figure or similar thing which is a structure or any part thereof, or is attached to, painted on, or in any other manner represented on a building or structure or device; and is used to announce, direct attention to, or advertise; and is visible from any public right-of-way. (5/98)



Sign Face

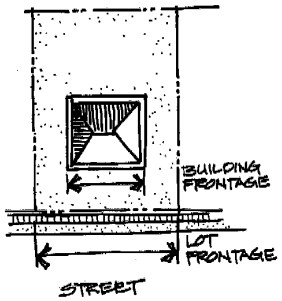
Sign Face: Surface of a sign containing the message. The sign face shall be measured as set forth in the definition for "area."

Sign Height: The distance from the finish ground level, to the top of the sign or the highest portion of the sign structure or frame, whichever is greater. (5/98)

Sign Structure: The supports, uprights, braces, framework and other structural components of the sign. (5/98)

Street Frontage: That portion of a property that abuts a paved street right-of-way and measured by the lineal distance of the property adjacent to such right-of-way. (5/98)

Temporary Business: A business of a temporary nature authorized through a Temporary Business Permit issued by the City of Keizer. (5/98)



Street Frontage

Temporary Sign. A sign not permanently affixed to a structure on a property. A sign that is, or is similar to, a banner or wind feather sign which may be made of canvas, cloth, rigid plastic or paper, or vinyl. (12/10)

Wall Sign: A sign attached to, erected against or painted on a wall of a building or structure, with the exposed face of the sign in a plane approximately parallel to the face of said wall. A sign painted on an awning in which the face of the sign is approximately parallel to the wall shall also be considered a wall sign. (5/98)

Temporary Sign

2.308.03 Review Procedures

A. Permit Required. Except as specifically excluded herein, no property owner, lessee or contractor shall construct or alter any sign without first obtaining a valid permit to do so. (5/98)

Wall Sign

B. Current Signs. Owners of conforming or nonconforming signs existing as of December 4, 1989 are not required to obtain a permit until the end of the abatement period described in Section 2.308.04.C. (5/98)

C. Permit Fees. Permit fees shall be established from time to time by City Council resolution. (5/98)

D. Application Requirements. An application for a sign permit shall be made on a form prescribed by the Zoning Administrator. The application shall include, at a minimum, a sketch drawn to scale indicating the proposed sign and identifying existing signs on the premises, the sign's location, graphic design, structural and mechanical design and engineering data which ensures its structural stability. The application shall also contain the names and address of the sign company, person authorizing erection of the sign and the owner of the subject property. (5/98)

The Zoning Administrator shall issue a permit for a sign unless the sign is in violation of the provisions of these regulations or other provisions of the Keizer Zoning Ordinance. Sign permits mistakenly issued in violation of these regulations or other provisions of the Keizer Zoning Ordinance are void. The Zoning Administrator may revoke a sign permit if he finds that there was a material and misleading false statement of fact in the application for the permit. (5/98)

E. Design, Construction, and Maintenance. All signs shall be designed, constructed, and maintained according to the following standards: (5/98)

1. Compliance with Building Codes. All signs shall comply with the applicable provisions of Uniform Building Code in effect at the time of the sign permit application and all other applicable structural, electrical and other regulations. The issuance of a sign permit under these regulations does not relieve the applicant of complying with all other permit requirements. (5/98)

2. Materials. Except for banners, flags, temporary signs, and window signs conforming in all respects with the requirements of these regulations, all signs shall be constructed of permanent materials and shall be permanently attached to the ground, a building, or other structure by direct attachment to a rigid wall, frame, or structure. (5/98)

3. Maintenance. All signs shall be maintained in a good structural condition and readable at all times. (5/98)

4. Owner Responsibility. The owner shall be responsible for its erection and maintenance and its compliance with the provisions of these regulations or other laws or Ordinances regulating signs. (5/98)

5. Aesthetics. All signs shall be professional in appearance, constructed in a workmanship like manner to professional standards. (12/10)

2.308.04 Nonconforming Signs

A. Alteration of Nonconforming Sign Faces. Nonconforming signs are subject to the following provisions regarding alteration: (5/98)

1. Change Permitted. Within the abatement period described in Section 2.308.04.C., a change in sign face alone is allowed without requiring compliance with these regulations. (5/98)

2. Termination of Nonconforming Sign. Within the abatement period described in Section 2.308.04.C., when a nonconforming sign face is damaged or destroyed by fire, flood, wind, or other calamity or act of God, such sign face may be restored to its original condition provided such work is completed within sixty (60) days of such calamity. However, a sign

structure or support mechanisms so damaged shall not be replaced except in conformance with the provisions of these regulations. (5/98)

B. Permits for Properties with Nonconforming Signs. (5/98)

1. Businesses in Integrated Business Centers. For individual businesses in integrated business centers, all signs of the individual business must comply prior to issuance of sign permits for new or altered signs. No free-standing sign permits will be issued for the integrated business center, unless all free-standing signs comply. (5/98)

2. Businesses Not in Integrated Business Centers. No permits shall be issued for new or altered signs unless all signs of the individual business comply with these regulations, except as set forth in Section 2.308.04.B.4. (5/98)

3. Nonconforming Sign Area. Except as set forth above and in Section 2.308.08.B.4., all conforming and/or nonconforming signs in existence as of the date of the permit application shall be included in the total allowed area, number or size when reviewing applications for new or altered signs to be allowed on the property. (5/98)

4. Exception for Non-Owned Signs. Signs which are not owned or controlled by the property owner or lessee prior to May 7, 1990, and which were constructed or installed prior to May 7, 1990, shall not be included in the total allowed area for sign permits granted prior to May 7, 1997. (5/98)

C. Abatement of Nonconforming Signs. Permanent signs in existence on May 7, 1990 that are not in conformance with the provisions of this Ordinance shall be regarded as nonconforming signs and must be removed, altered, or replaced so as to conform on or before May 7, 1997. The period from the date of the enactment of these regulations to May 7, 1997, shall be described as the "abatement period." Nonconforming signs remaining after the abatement period ends shall be considered illegal signs. Temporary and portable signs that are not in conformance with the provisions of this Ordinance shall be regarded as nonconforming and shall be removed on or before September 7, 1990. (10/08)

The Zoning Administrator shall notify non-conforming permanent sign owners by certified mail of the conformance deadline at least two years prior to such deadline as a public service. Failure to be notified of the deadline shall not relieve the owner of responsibility to conform with this Ordinance within the time period herein. Properties annexed to the City after the effective date of this Ordinance shall have 7 years following annexation in which to conform to these regulations, with the exception of temporary signs that shall conform to the regulations within 90 days following annexation. (5/98)

Electronic Message Signs which are legally placed and maintained in all respects on or before October 6, 2008 shall be allowed to remain as non-conforming signs and do not have to be brought into compliance. However, once a non-conforming

Electronic Message Sign is removed, any replacement sign must comply in all respects with these regulations. (10/08)

D. Abandoned Signs. All signs for a business shall be removed within 30 days after that business ceases to operate on a regular basis, and the entire sign structure or structures shall be removed within 12 months of such cessation of operation. (5/98)

E. Minor Nonconforming Signs. Individual signs that otherwise comply and are existing as of May 7, 1990, that are within 5% of both the allowed area (total and per sign) and the allowed height as set forth in these regulations are allowed to remain as nonconforming signs and do not have to be brought into compliance. However, once a nonconforming sign is removed, any replacement sign must comply in all respects with these regulations. (5/98)

2.308.05 Signs Generally Permitted

Subject to the limitations in Sections 2.308.04.C., 2.308.07 and 2.308.08, the following signs and sign work are permitted in all zones. These signs shall not require a permit, and shall not be included when determining compliance with total allowed area: (5/98)

A. Sign Copy. Painting, change of sign face or copy and maintenance of signs legally existing on the effective date of this Ordinance. If structural changes are made, the sign shall conform in all respects with these regulations. (5/98)

B. Temporary Signs. Temporary signs that do not exceed 16 square feet in area. No lot may display temporary signs for more than 120 days in any calendar year. Only one temporary sign per lot may be displayed at a time except during the period 45 days preceding and seven days following elections, signs which relate to such elections may be unlimited in number. Paper signs may only be used for single day events. (12/10)

C. Real Estate Signs. Signs that advertise the sale, rental or lease of premises upon which the sign is located. Commercial Properties may display a real estate sign not exceeding 16 square feet in area. Residential properties may display a real estate sign not exceeding 6 square feet in area. (12/10)

D. Government Signs. Signs posted by or under governmental authority including legal notices, traffic, danger, no trespassing, emergency, city identification, signs related to public services or safety, and signs approved by City Council resolution for special events or activities. (12/10)

E. Development Signs. One sign not over 32 square feet for a residential development or subdivision, and located at each street entrance to the development. (5/98)

F. Incidental. Incidental signs that do not exceed 6 square feet. Such signs shall not be mounted on permitted freestanding sign structures. (5/98)

G. Flags. Flags on permanent flag poles that are designed to allow raising and lowering of the flags. Flagpoles shall either be freestanding or shall be mounted on the building but if mounted on the building may not be taller than the peak of the roof. Flags shall not exceed 25 square feet in area. (5/98)

H. Interior Signs. Signs within a building. (5/98)

I. Window Signs. For commercial or industrial buildings, signs painted or hung on the inside of windows. (5/98)

J. Non-profit Signs. A non-profit organization may display a portable sign subject to the following: (5/98)

1. Three signs per organization at one time. (5/98)

2. Maximum sign area: 16 square feet. (5/98)

3. The sign shall be displayed no more than six times in any 365 day period, and shall not be displayed longer than five days each time. (5/98)

4. The sign shall not be placed on public property or in any right-of-way. (5/98)

5. The non-profit organization shall request and receive consent from the property owner of the property on which the sign is placed. (5/98)

6. If requested, the non-profit organization shall provide appropriate proof that such organization is organized not to make a profit, but for charitable, educational, religious, or philanthropic purposes. (5/98)

K. Residential Signs. Residential signs, pursuant to requirements in Section 2.308.07. (5/98)

L. Election Signs. During the period of forty-five (45) days prior and seven (7) days after any governmental election, signs which meet the definition of temporary or portable signs, and which pertain to such election, may be unlimited in number. (12/10)

M. Portable Signs. Portable signs may be displayed for a maximum of 120 days in any calendar year, and are limited to 6 square feet in area. The following additional standards apply to portable signs: (12/10)

1. Portable signs located within 10 feet of the main entry of a business may be displayed without limit to time. (12/10)

2. Portable signs not located adjacent to a business entrance may not be within 50 feet of any other portable sign on the same lot or less than 10 feet from a property line. (12/10)

3. Portable signs must be located on private property, and may not be within any public sidewalk easement or right of way. If located along a public street, signs must be located behind the sidewalk regardless of property line location. (12/10)

4. Portable signs cannot impede sidewalks, exits, or other pedestrian, vehicular, or bicycle way. (12/10)

5. Portable signs may only be displayed during business hours. (12/10)

2.308.06 Prohibited Signs

The following signs are prohibited: (5/98)

A. Tethered Signs. Balloons or similar types of tethered objects, including strings of pennants. (5/98)

B. Roof Signs. Roof signs or signs which extend higher than the roof line. (5/98)

C. Odor, Visible Matter. Signs that emit odor, visible matter, or sound, however an intercom system for customers remaining in their vehicles, such as used in banks and "drive through" restaurants, shall be allowed. (5/98)

D. Wire Supports. Signs that use or employ side guy lines of any type. (5/98)

E. Obstructing Signs. Signs that obstruct any fire escape, required exit, window or door opening used as a means of egress. (5/98)

F. Utility Lines. Signs closer than 24 inches horizontally or vertically from any overhead power line or public utility guy wire. (5/98)

G. Vehicle, Trailer Signs. No vehicle, trailer, or trailer mounted reader boards shall be parked on a public right-of-way or public property, or on private property so as to be visible from a public right-of-way which has attached thereto or located thereon any sign or advertising device for the basic purpose of providing advertisement of products or directing people to a business or activity located on the same or nearby premises. This provision applies where the primary purpose of a vehicle is for advertising purposes and is not intended to prohibit any form of vehicular sign, such as a sign attached to a motor vehicle which is primarily used for business purposes, other than advertising. (12/10)

H. Rotating/revolving Signs. (10/08)

I. Flashing Signs. (10/08)

J. Projection Signs. Projecting signs exceeding 24 inches and private signs that project into or over driveways and public right-of-ways, except signs under a

canopy that projects over a public sidewalk and the sign is 8 feet or more above the sidewalk. (11/05)

K. View Obstruction. Signs that obstruct required vision clearance area or obstruct a vehicle driver's view of official traffic control signs and approaching or merging traffic, or which present a traffic hazard. (5/98)

L. Safety Interference. Signs that interfere with, imitate, or resemble any official traffic control sign, signal or device, emergency lights, or appears to direct traffic, such as a beacon light. (5/98)

M. Use of Utility Poles. Signs attached to any pole, post, utility pole or placed on its own stake and placed into the ground in the public right-of-way. (5/98)

N. Vacant Land. Any sign on unimproved property, unless allowed as a temporary sign. (5/98)

O. Electronic Message Signs. Electronic message signs except by conditional use permit. Electronic message signs that change more frequently than once per fifteen (15) minutes are prohibited. Further, any change made with the use of scrolling, flashing, fluttering or other animated effects is prohibited. Variances to any of these requirements are not allowed. (10/08)

2.308.07 Non-Commercial Signs

The following regulations apply to signs for residences, public or semi-public buildings and similar non-commercial, non-industrial uses: (5/98)

A. Sign types. The following sign types are allowed: (5/98)

1. Wall, canopy and window signs subject to the limitations in 2.308.07.C. (5/98)

2. Free-standing signs subject to the limitations in 2.308.07.C. (5/98)

3. Temporary displays consisting of any sign type for a period not to exceed 21 days in any 365 day period, however the owners or responsible parties of such displays shall be responsible for any public or private nuisance. (5/98)

B. Maximum number. Any combination of wall, canopy or free-standing signs not exceeding the sign area and height limitations of this Section; plus signs allowed in Section 2.308.07.A.3. (5/98)

C. Maximum Sign Area. Maximum total sign area for property on which the building or buildings are located: (5/98)

1. Single-family and two-family (duplex) dwelling: 6 square feet. (5/98)

2. Multiple family dwelling: 32 square feet. (5/98)

3. Public and semi-public: 64 square feet. (5/98)

D. Maximum sign height:

1. Wall, canopy or window sign: 8 feet. (5/98)

2. Free-standing sign: 6 feet. (5/98)

E. Location: (5/98)

1. Wall, canopy or window sign shall be set back from the property lines of the lot on which it is located, the same distance as the building containing the permitted use; provided that wall signs may project into the required setback space up to 1.5 feet. (5/98)

2. Free-standing signs are permitted where fences are allowed. (5/98)

F. Illumination. Except for Electronic Message Signs, non-commercial signs may only be indirectly illuminated by a concealed light source, shall not remain illuminated between the hours of 11:00 p.m. and 6:00 a.m., (except by conditional use permit) and shall not flash, blink, fluctuate or produce glare. (10/2008 Ord. 2008-581)

2.308.08 Commercial and Industrial Signs

The following regulations apply to signs for commercial and industrial uses: (5/98)

A. Non-integrated Business Centers:

1. Total allowed area. One and one-half square feet of total allowed sign area for each lineal foot of building frontage, up to a maximum total allowed area of 150 square feet. (5/98)

2. Type, maximum number and size of signs. Within the total allowed area, one free standing sign per street frontage and an unlimited number of wall, canopy or projecting signs. Regardless of total allowed area, the free-standing signs shall be limited to a maximum of 100 square feet in area, shall not exceed one sign on each frontage, and shall be oriented to face the traffic flow on the street upon which then front. (5/98)

3. Maximum sign height: (5/98)

a. Wall and canopy signs shall not project above the parapet or roof eaves. (5/98)

b. Free-standing signs: 20 feet. (5/98)

4. Location: (5/98)

a. Wall or projecting signs may project up to 2 feet from the building. (5/98)

b. Free-standing signs have no limitations except the signs shall not project over street right-of-way and shall comply with requirements for vision clearance areas and special street setbacks. (5/98)

B. Integrated Business Centers:

1. Allowed area. For wall, canopy and projecting signs on individual businesses within an integrated business center, one and one-half square feet of total allowed sign area for each lineal foot of building frontage for the individual business, up to a total maximum of 150 square feet per business. The sign area of a projecting sign shall be calculated as a free-standing sign. Individual businesses may not assign their unused allowed area to other businesses in the integrated business center. Free standing signs are permitted only as set forth below and in Section 2.308.08.C. (11/05)

2. On a Secondary Building Frontage, one wall sign shall be allowed, in addition to that listed above, at the rate of 0.75 sq ft per lineal foot of that portion of the building designated a Secondary Building Frontage, up to a maximum of 75 sq ft. (11/05)

3. Free-standing Sign. For each integrated business center, 1 free-standing sign per street frontage not to exceed 100 square feet in area. Free-standing signs shall not exceed one sign on each frontage and shall be oriented to face the traffic flow on the street upon which they front. (11/05)

4. Maximum sign height: (5/98)

a. Wall and canopy signs shall not project above the parapet or roof eaves. (5/98)

b. Free-standing signs: 20 feet. (5/98)

5. Location:

a. Wall or projecting signs may be located on any face of the building, except as provided in 2.308.08.B.4.b, and may project up to 2 feet from the building. (11/05)

b. Wall signage located on a Secondary Building Frontage shall be limited to only one sign, limited in size as provided in 2.308.08.A.2. In no case may any signage derived on the primary building frontage be located on the secondary building frontage. (11/05)

c. Free-standing signs have no limitations except the signs shall not project over street right-of-way and shall comply with requirements for vision clearance areas and special street setbacks. (5/98)

C. Mixed Use Developments. Signs for developments containing a mixture of commercial and residential uses shall be subject to the following restrictions: (5/98)

1. Non-commercial uses shall be subject to the provisions in Section 2.308.07. (5/98)

2. Commercial-industrial uses shall be subject to the provisions for integrated business centers in Section 2.308.8.B. (5/98)

3. Free-standing signs shall be subject to the provisions in Section 2.308.08.B.2. (5/98)

D. Additional Signs. Within the limitations of this subsection, the signs below do not require a permit and are not included in calculating allowed area and number of signs. (5/98)

1. Secondary Entrance. When a business has two public entrances, each on a separate building wall, there is permitted one additional wall sign not to exceed 10 square feet in area for the wall where the entrance is not the primary entrance. (5/98)

2. Directional Signs. Directional signs, such as "Exit" or "Entrance", are allowed either as wall or freestanding signs. Such signs shall be limited to 3 square feet in area and 2 per driveway. Free standing directional signs shall be limited to a height of 6 feet. (5/98)

3. Menu Boards. Order signs describing products and/or order instructions to a customer, such as menu boards on the exterior of a drive-through restaurant are allowed as follows: one per business limited to 40 square feet in area and a maximum height of 8 feet. Any order sign greater than 10 square feet in area and/or 6 feet in height must be screened from adjacent streets by a sight obscuring fence, wall or hedge. (11/05)

E. Signs for Temporary Businesses. Temporary businesses may display temporary or portable signs, other than trailer mounted reader boards or any sign that includes flashing or rotating lights or moving parts. The cumulative size of all such signs may not exceed 32 square feet. All temporary signs must be placed within 10 feet of the structure or vehicle used for the temporary business and may not be placed within any public right-of-way. (5/98)

F. Signs for Mobile Food Vendors

1. In addition to the signs allowed in Section 2.308.08(F)(2) below, Mobile Food Vendors shall be limited to 6 square feet of signage which can be displayed only during hours of operation and shall comply with the provisions within Section 2.308.05.M (1) thru (5) but exempt from the time limit provision. (07//17)

2. Signs painted upon or affixed directly to the Mobile Food Vendors are exempt from the Sign Code provisions, provided that no sign may protrude from or project above the roofline of the unit. All other signage must comply with the remaining provisions of Section 2.308. (07//17)

3. Property on which two or more Mobile Food Vendors are located shall comply with the remaining provisions within the Sign Code. (9/16)

G. Special Commercial Signs

1. Home Occupation. Maximum area shall be 6 square feet and subject to the location provisions in Section 2.306.07. (5/98)

2. Residential Sales Office. Maximum area shall be 16 square feet and subject to the location provisions in Section 2.306.07. (5/98)

3. Bed and Breakfast. Maximum area shall be 16 square feet and subject to the location provisions in Section 2.306.07. (5/98)

4. Signs for stadiums in the IBP Zone. Notwithstanding any other regulations in this Chapter, in the IBP zone for stadiums with seating for not less than 4,000 persons, the following shall apply: (11/05)

   a. Total allowed area. 760 square feet. (11/05)

   b. Type, maximum number and size of signs. Within the total allowed area, one (1) free standing sign, and a total of no more than two (2) wall or canopy signs. Regardless of the total allowed area, the free standing sign shall be limited to a maximum of 680 square feet. (11/05)

   c. Maximum sign height: (11/05)

      1. Wall and canopy signs – shall not project above the parapet or roof eaves. (11/05)

      2. Free standing sign – maximum total height of fifty (50) feet. (11/05)

   d. Location:

      1. Wall signs – may project up to 1.5 feet from the building. (11/05)

2. Free standing sign – no limitation except shall not project over street right-of-way and shall comply with requirements for vision clearance areas and special street setbacks. (11/05)

2.308.09 Conditional Uses

A. Procedures. Applications for conditional use permits for illumination of non-commercial signs, or electronic message signs shall be processed according to the procedure set forth in Section 3.103 of this Ordinance. The criteria to be reviewed and applied in conditional use permit proceedings for illumination of non-commercial signs or electronic message signs are set forth in this Section. The criteria of Section 3.103 shall not be applied. (Ord 2008-581 10/2008)

B. Decision Criteria. The following criteria shall be used to review and decide conditional use permit applications for the illumination of non-commercial and electronic message signs: (10/2008 Ord 2008-581)

1. The proposed sign is located in an EG, P, IBP, CR, CO, MU, CM or a CG zone. (10/08)

2. The proposed sign, when conditioned, will not either: a) significantly increase or lead to street level sign clutter, or b) lead to signs adversely dominate the visual image of the area. (10/08)

3. The proposed sign, as conditioned, will not adversely impact the surrounding area to a significant degree. Electronic Message Signs that are proposed to be located in a P zone adjacent to residential areas shall include mitigation measures such as screening and buffering or other measures to mitigate any impacts onto adjacent properties. Electronic Message Signs proposed to be located in the P zone adjacent to residential areas shall only be illuminated between the hours of 6:00 AM and 11:00 PM and may only be changed once in a 24 hour period. (10/08)

4. The proposed sign will not present a traffic or safety hazard. (5/98)

5. If the application is for the illumination of non-commercial or electronic message sign, no rotary beacon lights, zip lights, strobe lights, or similar devices shall be allowed. No chaser effect or other flashing effect consisting of external lights, lamps, bulbs or neon tubes are allowed. (10/08)

   Electronic Message Signs. Electronic Message signs must remain static and unchanging for a period no less than fifteen (15) minutes. Further, the level of illumination must be limited in the following ways:

   a. (A) An electronic message sign that contains a changeable display produced by light emitting diodes, incandescent or low-voltage lamps or bulbs, or cathode ray tubes shall include automatic brightness compensation features to adjust brightness to compensate for the angle and ambient light conditions.

b. No electronic message sign may be illuminated to a degree of brightness that is greater than 7,500 nits in the daytime and 1,000 nits between sunrise and sunset; provided that electronic message signs comprised solely of one color may not be illuminated to a degree of brightness exceeding the following illumination levels:

1. For a display comprised of red only, the degree of brightness shall not be greater than 3,150 Nits in the daytime and 450 between sunrise and sunset;

2. For a display comprised of green only, the degree of brightness shall not be greater than 6,300 nits in the daytime and 900 nits between sunrise and sunset;

3. For a display comprised of amber only, the degree of brightness shall not be greater than 4,690 Nits in the daytime and 670 nits between sunrise and sunset. (10/08)

6. The total allowed sign area for a business shall be reduced by 25% if the business has an electronic message sign. (10/08)

7. The proposed sign will comply with all other regulations, including, but not limited to height and placement restrictions. (5/98)

2.308.10 Variances

A. Procedure. Any allowance for signs not complying with the standards set forth in these regulations shall be by variance. Minor variances under Section 3.105.04 of this Ordinance shall not be allowed. Variances to this Section will be processed according to the procedures in Section 3.202.02 as a Type I-B procedure. The criteria in Section 3.105 shall not be used, but instead the following criteria shall be used to review and decide variance applications: (11/05)

1. There are unique circumstances of conditions of the lot, building or traffic pattern such that: (5/98)

a. The existing sign regulations create an undue hardship; (5/98)

b. The requested variance is consistent with the purpose of this chapter as stated in Section 2.308.01; and

c. The granting of the variance compensates for those circumstances in a manner equitable with other property owners and is thus not a special privilege to any other business. The variance requested shall be the minimum necessary to compensate for those conditions and achieve the purpose of this chapter. (5/98)

2. The granting of the variance shall not: (5/98)

a. Decrease traffic safety nor detrimentally affect any other identified items of public welfare. (5/98)

b. Result in a special advertising advantage in relation to neighboring businesses or businesses of a similar nature. The desire to match standard sign sizes (for example, chain store signs) shall not be listed or considered as a reason for a variance. (5/98)

c. Be the result of a self-imposed condition or hardship. (5/98)

2.308.11 Exemptions

The following are exempt from the regulations of this Chapter, but may be subject to other regulations under this Development Code or other City regulations:

A. Public Art as defined by City Ordinance or Resolution. (3/14)

Statistical Analysis of the Relationship between On-Premise Digital Signage and Traffic Safety

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ABBREVIATIONS

The abbreviations shown below are used in this report.

AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
BIC	Bayesian Information Criterion
CEVMS	Commercial Electronic Variable Message Signs
CG	Control Group
DF	Degrees of Freedom
EB	Empirical Bayes
EBB	Electronic Billboard
FHWA	Federal Highway Administration
HSIS	Highway Safety Information System
HSM	*Highway Safety Manual*
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
MS	Mean of Sum of Squares
MSE	Error Mean Square
MST	Treatment Mean Square
RTM	Regression to the Mean
SAR	Spatial Autoregressive Model
SEM	Spatial Error Model
SFI	Signage Foundation, Inc.
SPF	Safety Performance Function
SS	Sum of Squares
SSE	Sum of Squares for Error
SST	Total Sum of Squares
TTI	Texas A&M Transportation Institute

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EXECUTIVE SUMMARY

The use of digital on-premise signs, which are typically business-related signs that have the ability to change the displayed message, has increased significantly in recent years. On-premise digital signs are located on the same property as the businesses they promote, and some part — or a significant part in some cases — of the sign contains a digital display that can be programmed to change the message at pre-set intervals. Because the use of these signs has increased, jurisdictions have used local sign codes or ordinances to regulate the manner in which digital messages are displayed. Jurisdictions typically justify these regulations by citing traffic safety impacts. However, no comprehensive and scientifically based research efforts have evaluated the relationship between on-premise digital signs and traffic safety.

In this study, researchers collected large amounts of sign and crash data in order to conduct a robust statistical analysis of the safety impacts of on-premise digital signs. The statistical tools used the latest safety analysis theory developed for analyzing the impacts of highway safety improvements. The research team acquired the crash data from the Highway Safety Information System, which is a comprehensive database of crash records from several states. One of the advantages of these data is that they also include information about roadway characteristics, such as the number of lanes, speed limit, and other factors. The research team then acquired information about the location of on-premise digital signs from two sign manufacturing companies. Through significant effort by the researchers, these two datasets were merged into a single dataset that represented potential study locations in California, North Carolina, Ohio, and Washington. Of the initial set of over 3,000 possible sites, the research team was able to identify 135 sign locations that could be used for the safety analysis. Potential sites were eliminated from consideration due to any of the following factors:

- The sign location was not on a roadway that was included in the crash dataset; only major roads were represented in the crash data.
- The sign location provided by a sign manufacturing company could not be verified through online digital images of the location.
- Only signs installed in calendar years 2006 or 2007 could be included in order to have adequate amounts of crash data before and after the sign was installed.

The research team then used the empirical Bayes method to perform a before-after statistical analysis of the safety impacts of the on-premise digital signs. In a before-after study, the safety impact of a treatment (in this case, the installation of an on-premise digital sign) is defined by the change in crashes between the periods before and after the treatment was installed. However, simply comparing the crash frequencies (known as a naïve before-after analysis) is not adequate to account for factors such as regression to the mean (a statistical concept that explains why after data can be closer to the mean value than the before data) and to provide a means of controlling for external factors that can also cause a difference in crash frequencies. The empirical Bayes method represents the recommended procedure for evaluating the impacts of safety treatments because it overcomes the deficiencies of the naïve method. The safety impacts are represented by the safety index, which is indicated by the symbol θ. In simple terms, the safety index represents a ratio of safety in the after period compared to safety in the before period, although it is not as

simple as dividing the crashes in the after period by the crashes in the before period. A safety index greater than 1.0 indicates an increase in crashes in the after period, and a value less than 1.0 indicates a reduction in crashes in the after period. However, because of the variability in the crash data, the analysis must have statistical validity. Statistical variability is established by defining the 95 percent confidence interval for the safety index, which is based on factors such as sample size and the variability of the data. If the 95 percent confidence interval includes the value of 1.0, then there is a 95 percent chance that there is no statistically significant change in crashes between the before and after periods.

The results of the statistical analysis are presented in Figure 1. This figure shows that the safety index for all of the states was 1.0 with a 95 percent confidence interval that ranged from 0.93 to 1.07. This indicates that, for the 135 sites included in the analysis, there was no statistically significant change in crashes due to the installation of on-premise digital signs. The same can also be said about the results for each of the four states on an individual basis because the confidence interval for safety index for each state includes 1.0. The larger confidence intervals for some of the states are due to greater variability in the data and/or smaller sample sizes. The researchers also analyzed single-vehicle and multi-vehicle crashes and found the same result of no statistically significant change in crashes. Finally, the researchers performed an analysis of variance for the sign factors of color, size, and type of business and found no statistically significant differences in the mean safety index values for individual factors.

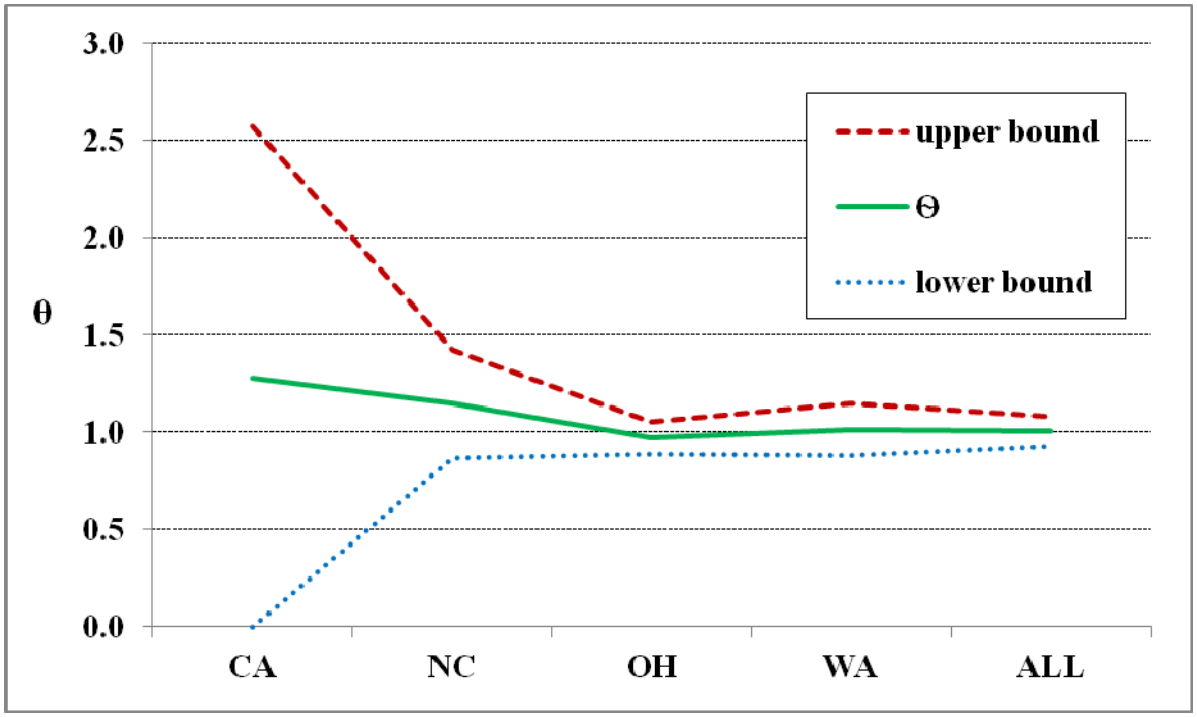

Figure 1. Summary of study results

The results of this study provide scientifically based data that indicate that the installation of digital on-premise signs does not lead to a statistically significant increase in crashes on major roads.

CHAPTER 1:
INTRODUCTION

For many generations, most signs — including both traffic and business signs — were static. They displayed only one message that did not change with time. Advances in information display technologies in recent years have led to an increase in the use of many types of digital signs, particularly in the area of on-premise and off-premise business signs. On-premise digital signs provide the ability to communicate a wide variety of messages and to change the manner in which the message is presented over time. As such, these digital signs represent a significant advancement in communication technologies and the ability to deliver valuable marketing information to potential customers. However, some groups have raised questions related to the traffic safety aspects of business signs that change messages on a frequent basis. The traffic safety concerns are often related to issues of potential driver distraction from the roadway due to the dynamic nature of these signs. These safety concerns are sometimes addressed through local regulation of these types of signs, which may prohibit or limit the use of on-premise digital signs. These regulations tend to be developed at the local level and do not have a significant level of scientific, nationally based research supporting the regulations.

The traffic safety concerns associated with on-premise digital signs have existed for some time, but there has been little research, particularly on a national level, that directly addresses the safety impacts of on-premise digital signs. In part, this is due to the fact that the use of such signs has grown only in the last 5–10 years. The research described in this report was conducted to provide a scientifically based, national analysis of on-premise digital signs so that the traffic safety impacts of such signs can be better understood.

RESEARCH APPROACH

The basic research method used in this study is a before-after statistical analysis of the change in traffic crashes at locations where digital signs were installed. The research team used digital sign installation information provided by sign manufacturers to identify locations in selected states where digital signs had been installed in the 2006–2007 time frame (this time frame was selected to provide adequate numbers of crashes in both the before and after periods). The analysis locations were limited to California, North Carolina, Ohio, and Washington because these states are part of the Federal Highway Administration (FHWA) Highway Safety Information System (HSIS). The HSIS is a database of crash records that includes detailed information about the roadway and crashes, including such factors as the number of lanes, the speed limit, crash severity, and other factors. The researchers then mapped the sign sites to the crash datasets to identify locations with crashes. These locations were then analyzed to compare the crashes before installation of the digital sign to the crashes after installation of the sign using statistical analysis procedures.

DESCRIPTION OF A DIGITAL SIGN

For the purposes of this study, a digital sign is defined as a sign that uses an electrical display, such as a liquid crystal display (LCD) or light-emitting diode (LED), to provide changeable

messages or graphics. There are several types of digital signs, including digital billboards, indoor video advertisements, and street-level advertisements (such as LED signs on bus shelters). For this study, the researchers focused only on on-premise digital signs, which are signs located on the same property as the business with which they are associated. The research effort did not include or address off-premise signs or billboards.

RESEARCH ACTIVITIES AND REPORT ORGANIZATION

There were five major activities associated with this research effort. The study began by reviewing and evaluating previous research on the safety aspects of digital signs and the statistical methods that other researchers have used to evaluate the safety aspects of signs. Chapter 2 describes the results of the review of background information. The researchers then began to collect information related to digital signs and crash data in the selected states. The sign information included the location and date of installation, and the crash data included the location and date. The researchers then devoted extensive effort to matching the locations and dates of the signs and crash datasets. Chapter 3 describes the sign and crash data and how the two datasets were merged together. Once this was accomplished, the next step was to develop a valid and scientifically based statistical analysis procedure to determine if there were any statistically significant changes in crashes after installation of digital signs. Chapter 4 describes the development of a statistical methodology, including a comparison of the advantages of the different options for conducting the statistical analysis. Finally, the research team used the results of the statistical analysis to define the key study findings, which are described in Chapter 5. Chapter 6 presents the conclusions and recommendations for the research study.

CHAPTER 2:
BACKGROUND INFORMATION

This chapter provides a review of the literature related to on-premise digital signs and their impacts on traffic safety. The review also includes a summary of statistical methods that can be used for evaluating the safety effects for these types of signs. Although the majority of the work has been related to off-premise digital signs, key studies associated with off-premise signs are nonetheless briefly discussed here. It should be pointed out that compared to other types of roadway-related operational and design features, such as access point density on urban arterials or on-street parking designs, the number of documents that are related to either on- or off-premise signs is relatively small.

On-premise signs are signs that are located on the same property as the activity described in the sign, while off-premise signs are located away from the activity identified in the sign. Off-premise signs are also known as third-party signs or outdoor advertising, and the most common example is a billboard. In general, off-premise signs have a larger visible area, which is attributed to the fact that these signs usually have greater surface areas and have higher mounting heights than on-premise signs. Furthermore, off-premise signs have a larger viewership because they are usually located adjacent to freeways and major highways with higher traffic volume. On the other hand, on-premise signs are installed on private property where a company conducts its business, and most are located along urban streets or local roadways. According to *The Signage Sourcebook* (U.S. Small Business Administration, 2003), the viewing opportunities for outdoor advertising (typically 333,350 cars per day) are much greater than those for an on-premise sign (30,000 cars per day).

The literature review is divided into two sections. The first section summarizes studies related to on-premise digital signs. The second section presents the summary of two key studies associated with off-premise digital signs.

ON-PREMISE DIGITAL SIGNS

This section describes the characteristics of the studies that have examined the relationship between safety and on-premise digital signs. To the knowledge of the authors, only two studies have investigated this relationship. It should be pointed out that the safety relationships identified in these research documents were not based on crash data but more on opinions and hypotheses, which limits their value as a direct measure of on-premise sign safety. The first study was conducted by Mace (2001). This author performed a literature review and listed two hypotheses about how on-premise signs can influence crash risk. The first hypothesis states that on-premise business signs distract drivers' attention from their primary driving tasks, resulting in higher crash risks. The second hypothesis asserts that on-premise business signs may mask the visibility of regulatory and warning road signs, which also can negatively influence crash risk.

On the other hand, Mace (2001) noted positive effects associated with commercial signs. He reported that commercial signs could reduce unnecessary traffic exposure by providing adequate navigation information for drivers, such as providing restaurant information for hungry drivers.

However, only measuring the frequency and duration of drivers' distraction may not represent the safety impacts of on-premise signs because a study published earlier showed that half of the objects that drivers see are not related to driving tasks (Hughes and Cole, 1986). In other words, besides on-premise signs, other roadside features may also distract drivers. The possible solution to minimize the negative effects of an on-premise sign, but still keep its positive effects, is to separate the sign's content to primary (navigation) and secondary (commercial) information.

Although, in the past, on-premise signs and off-premise signs were treated as distinct signage, they are becoming more homogeneous in terms of characteristics. In the second study, Wachtel (2009) mentioned that more roadside businesses, especially those with multiple users (e.g., shopping centers, auto malls, sports complexes, and entertainment places), now install larger-sized on-premise digital signs because of the lower cost and better performance of the LED display. Wachtel indicated that the largest digital advertising sign in the world is an on-premise sign in New York City. This sign is 90 ft tall and 65 ft wide, and is mounted on a 165-ft-tall steel post on the roof of the warehouse. The visible distance is over 2 miles. Wachtel also suggested that some on-premise signs affect traffic safety more than some off-premise digital signs because the locations and elevations of on-premise signs might be closer to the road users. In addition, the angles of on-premise signs may be out of the cone of vision and require extreme head movements to read.

In summary, these two studies showed more research is needed for understanding the relationship between on-premise digital signs and crash risk.

OFF-PREMISE DIGITAL SIGNS

This section is divided into two parts. The first part describes two key studies that have examined the safety effects of off-premise digital signs. The second part covers methodologies that have been used for estimating these effects.

Safety Effects

There are two reports that provide reviews of the findings, methods, and key factors related to the safety effects of off-premise digital signs. The first systematic study related to the impacts of off-premise signs was conducted 11 years ago by Farbry et al. (2001). Their study reviewed earlier reports and analyses (including those about electronic billboards and tri-vision signs) and provided the foundation for the second study written by Molino et al. (2009). In the second report, Molino et al. (2009) reviewed 32 related studies, which included those initially reviewed by Farbry et al. (2001), and noted that the majority of studies reported a negative effect between digital billboards and traffic safety. Although the number of studies that showed harmful impacts is five times more than the number of studies that showed no harmful impacts, the authors suggested that this ratio may not be strong evidence to prove the negative effects linked to electronic billboards (EBBs). The individual studies considered by these researchers had very different study methods and statistical powers, which can have a significant effect on the quality and results of the research.

Another important finding in the Molino et al. (2009) report is that drivers usually have spare attention capacities, and they can be distracted from their driving tasks by roadside objects (such as EBBs). However, these distractions may be riskier when the driving demands increase, such as in fixed hazard areas (e.g., intersections, interchanges, and sharp curves), in transient risky conditions (e.g., adverse weather, vehicle path intrusions, and slow traffic), or when other important information is processed at the same time (e.g., an official traffic sign). In other words, not only will the sign's internal characteristics (overall size, legend size, color, contrast, luminance level, etc.) affect crash risk, but so will external environmental factors (type of road, speed, weather conditions, time of day, etc.). Hence, Molino et al. list all possible key factors and suggest further studies to examine how they could influence safety. These factors are categorized into two groups: independent and dependent variables. The independent variables are separated by subject into five subgroups: billboard, roadway, vehicle, driver, and environment. It should be noted that the relationship between EBBs and on-premise signs is discussed in the environment subgroup, and dynamic factors of on-premise signs, such as change rate, motion, video, and sound, are listed as extremely important. The dependent variables are separated into vehicle behavior, driver/vehicle interaction, driver attention/distraction, and crash categories. Since there are hundreds of related key factors, the authors claimed that "No single experiment can provide the solution" and suggested future research programs to address the following topics: (1) determining when distraction caused by commercial electronic variable message signs (CEVMSs) affects safe driving, (2) investigating the relationship between distraction and various CVEMS parameters, and (3) examining the relationship between distraction and safety surrogate measures, such as eye glance and traffic conflicts.

Table 1 summarizes the literature review results from these two reports. This table shows that the results of crash studies are not consistent, and most studies have some important weaknesses, such as neglecting biases related to the regression to the mean (RTM) (discussed below) and site-selection effects (using the naïve method), low statistical power, and analysis results based on erroneous assumptions. It should be noted that only post-hoc crash studies are listed here because this study focuses on the change of crash rate caused by on-premise digital signs.

As mentioned, Table 1 shows that the results related to the safety effects of off-premise signs are inconsistent. The inconsistencies can be fully or partly attributed to various study limitations. For instance, the studies in the Wachtel and Netherton report (1980) and Wisconsin Department of Transportation report (1994) both used a naïve before-after study methodology (methodology approaches are described in Chapter 4), and they did not account for the RTM bias, which may change their estimates of crash rate and safety effects of signs. The general idea of RTM is that when observations are characterized by very high (or low) values in a given time period and for a specific site (or several sites), it is anticipated that observations occurring in a subsequent time period are more likely to regress toward the long-term mean of a site (Hauer and Persaud, 1983). Also, these studies should provide the variance of estimators (that is the uncertainty associated with the estimator) for judging the statistical significance of their results. Moreover, grouping studies where the objectives or types of signs are different is not appropriate. For example, the goal of the report prepared by Tantala and Tantala (2007) was to study the safety impacts caused by converting traditional billboards to digital billboards, while other studies focused on the safety impacts after installation of new digital billboards. Those are two distinct effects that are examined and should not be grouped together to evaluate the safety effects of on-premise digital

signs. Wachtel (2009) also noted other limitations in Tantala and Tantala's study, such as a lack of adequate before-after and comparison group data; no clear definition and reasonable calculation of the visual range and legibility range of EBBs; and no crash data related to adverse weather, impaired drivers, and interchanges.

Table 1. Safety effects of off-premise digital signs

Study	Methods	Data Type	Results	Location	Sample Size
Wachtel and Netherton (1980)	Naïve before-after study	Crash frequency	The crash reduction of target area was 10% less than the overall reduction (after the installation of the signs)	Tele-Spot sign, Boston	Not provided
Wisconsin Department of Transportation (1994)	Naïve before-after study	Crash frequency, Average daily traffic (ADT)	Crash rate (eastbound): all crashes increased 36%, sideswipe crashes increased 8%, and rear-end crashes increased 21%	Milwaukee, Wisconsin	2
			Crash rate (westbound): all crashes increased 21%, sideswipe crashes increased 35%, and rear-end crashes increased 35%		
Smiley et al. (2005)	Before-after study (empirical Bayes)	Crash frequency, ADT, safety performance function	Downtown intersection sites: no significant change in crash rate (all crashes increased 0.6%, injury crashes increased 43%, and rear-end crashes increased 13%)	Toronto, Canada	3
	Before-after study (control group)	Crash frequency, ADT, control group	Rural sites: no significant change in crash rate based on most compared sites	Toronto, Canada	1
Tantala and Tantala (2007)	Naïve before-after study	Crash frequency, control group, ADT	No significant change in crash rate	Cuyahoga, Ohio	7
Tantala and Tantala (2009)	No description of the method		No significant change in crash rate	Cuyahoga, Ohio	7

The second shortcoming in Tantala and Tantala (2007) is that they used a simple correlation analysis between sign density and crash rate to examine safety effects of billboards. Using this approach, they found that the correlation coefficients among the scenarios analyzed were very low (around 0.20), indicating that the installation of billboards did not increase the number of crashes. This may well be true, but they did not use the right analysis tool. For investigating the relationship between sign density and the number of crashes, it is more appropriate to develop one or several regression models since the safety analyst can have a better control over other factors that can influence the number and severity of crashes (Lord and Mannering, 2010). In a regression model, several independent variables can be included, which is better to estimate the variable of interest (such as the installation of digital signs). However, it should be pointed out that the before-after study, as performed in this study, still remains the best methodological approach for estimating the safety effects of an intervention.

Among all studies in Table 1, Smiley et al. (2005) provides the more reliable results since they used a before-after method using a control group (CG) and empirical Bayes (EB) approach. The

only limitation is related to the small sample size. The authors of the study only evaluated three sites. Even with a small sample size, the EB method can still be successfully used to evaluate the safety effects of an intervention, as was done by Ye et al. (2011). Ye et al. (2011) used the EB method to estimate the safety impacts of gateway monument signs, which can be categorized as one type of off-premise sign. Gateway monuments are roadside structures used to introduce a city or town. These monuments usually have the name of the city or town and are located at the city limits.

According to Wachtel et al. (2009) and Farbry, (2001), using crash data might not be a precise method because crashes usually have multiple causal events, which are difficult to extract from crash datasets. For example, they noted that sign internal variables (such as size, brightness, viewing angle, etc.) might play main roles in drivers' distraction or ignoring of official traffic signs, while other external factors affect conflicts and crash risk. Although those reasons may be legitimate, utilizing crash data is still the best approach for evaluating the safety effects of interventions as well as those associated with operational and design features (Hauer 1997). As stated by Hauer, "*It follows that, in the final account, to preserve the ordinary meaning of words, the concept of safety must be linked to accidents.*" Furthermore, using crash data have other advantages: lower cost and fewer artificial errors. Firstly, the cost of conducting a before-after crash study is much lower than human-centered methods because the researchers do not need to purchase equipment and hire participants for conducting driving tests. Secondly, crash data are based on crash reports, which can provide a more accurate measure of safety than surrogate measures such as speed, driver behavior, or other measures. Only by conducting a before-after crash study can one provide results that combine multiple casual variables in the real world. Other methods cannot displace the above advantages, which explain why the research team selected the before-after methodology for estimating the safety effects of digital signs.

Characteristics of the Evaluation Methods Used in Previous Studies

This section describes the characteristics of other methods used in previous studies for examining the safety effects of off-premise digital signs. In addition to a crash before-after study approach, the most common study methods that have been used for examining the safety impacts of off-premise signs include eye fixations, traffic conflicts, headways and speeds, and public surveys. Most studies used one or more of the above methods to examine the impacts of off-premise signs (Molino et al., 2009). For instance, Smiley et al. (2005) used four different methods (eye fixation, conflict study, before-after crash study, and public survey) for examining a video sign located in Toronto. On the other hand, Lee et al. (2007) used eye fixations and a questionnaire for their study. It should be noted that the results from multiple measurements are usually inconsistent.

Briefly, the eye fixation study method uses an eye-tracking system to record drivers' eye movements. The results (e.g., eye glances and durations) can provide direct evidence of where drivers are looking while driving, leading to assumptions as to whether drivers are distracted when they are driving near or toward a sign (or at other roadside features). Traffic conflicts, often referred to as surrogate measures of safety, can be used for identifying risky driving behaviors, such as braking without good reason, inappropriate lateral lane displacement, and delays at the start of the green traffic signal phase. Headways and vehicle speed can be used to

assess distracted drivers since those drivers tend to have shorter headways and higher speed variances.

Most details about experiment design, such as the participant number, study site size, driving route length, and experiment duration can be found in Appendix B of the report prepared by Molino et al. (2009). In the current study, the researchers focus the discussion on the before-after crash data study method for two reasons. First, Molino et al. (2009) did not provide a detailed experimental design for using crash data, and some studies were criticized for inappropriate methodology (Tantala and Tantala, 2007; 2009). Second, the costs associated with other experimental methods are significant and are greater than the resources that were allocated for the current research study. According to Molino et al. (2009), the budgetary costs to conduct research using other experimental methods vary between $0.4 million and $0.8 million for using on-road instrumented vehicles, $2 million and $4 million for conducting a naturalistic driving study, and $1 million and $3 million for using an unobtrusive observation approach.

CHAPTER 3:
STUDY DATA

To conduct the safety analysis, the research team had to develop plans for collecting the necessary data, manipulating the data into a format that could be used for the safety analyses, and then conducting the statistical analysis to identify the safety impacts of on-premise digital signs. The success of this project relied upon the ability to acquire two distinct sets of data and the robustness of the individual datasets. The two datasets needed for the analysis included (1) information regarding the location and installation dates for on-premise digital signs, and (2) data regarding crash histories on the roadways in the vicinity of the on-premise digital signs. The latter also included information about operational (e.g., traffic flow and speed limit) and geometric (e.g., functional class and lane width) design features located at and adjacent to the on-premise digital signs. From the beginning of the project, the research team expected to use the HSIS crash data for the crash history dataset. The real challenge of this project was identifying specific information about on-premise digital signs for the states represented in the HSIS, and the researchers encountered numerous challenges in acquiring this information. Once the data for both groups were acquired, the researchers had to overcome differences in the datasets so that the data could be merged into a single dataset for analysis. The activities associated with the acquisition of the crash data, acquisition of the sign data, and the merging of the two datasets are described in this chapter.

CRASH DATA

The HSIS is operated and maintained by the FHWA, and is widely used for safety research programs that provide input for public policy decisions. The HSIS is a multistate relational database that contains crash, roadway, and vehicle information. Crash information/files contain basic crash information, such as location (based on reference location or mile-point), time of day, lighting condition (e.g., daylight, dark and no lighting, dark and roadway lighting, etc.), weather conditions, crash severity, the number of related vehicles, and the type of crash (e.g., head-on, right angle, sideswipe, etc.). Each row in the spreadsheet file contains crash information for individual crashes and a unique ID number, and each column represents a variable. The roadway information/files provide traffic and geographic information for each roadway segment, such as annual average daily traffic (AADT), speed limit, beginning mile-point, end mile-point, number of lanes, lane and median width, shoulder width and type, rural or urban designation, and functional classification. The vehicle information/files contain driver and vehicle information, such as a crash identification number, driver gender, driver age, contributing factor (possible casual factor), vehicle type, and others. These individual file types can be linked together as a whole dataset. For example, crash files and road files can be linked by their location information (route number and mileage), or crash files and vehicle files can be linked together by their crash identification number.

Currently, there are seven states that actively participate in the HSIS: California, Illinois, Maine, Minnesota, North Carolina, Ohio, and Washington. However, the HSIS has an upper limit on the amount of data that can be requested by researchers (including the number of states, the request area, and total variables). To maximize the value of the crash data that they could request, the

research team held discussions with the research advisory panel to identify the states (from the list of seven HSIS participating states) where there would be higher concentrations of on-premise digital signs. Based on this input, the research team requested HSIS data for California, North Carolina, Ohio, and Washington in order to get a maximum number of study sites. All crash datasets were downloaded from the HSIS website and stored in a spreadsheet format. The definitions for the variables in a state's crash data were found in the HSIS guidebooks. It should be noted that each state has its own guidebook and data record format. In other words, one specific variable might be available for some states, but this variable may have different meanings or category types, or even be unavailable for other states. The inconsistent definitions among different states' crash datasets can affect the quality of analysis and results when selecting specific variables for identifying target crashes (such as rear-end crash) needed for more advanced analysis. The differences between states also create challenges when trying to merge data into a single dataset for analysis.

Although the HSIS dataset provides the most comprehensive crash data from different states, the HSIS has some limitations. First, the HSIS only includes crashes that occur on major roads, such as interstate highways, U.S. highways, and state highways. The HSIS dataset may not include crash-related data for secondary roads in rural areas or city streets in urban areas, including arterial streets that are major roads in a city but are not on the state highway system. Table 2 identifies the level of crash coverage and roadway length for each state selected for the analysis.

Table 2. HSIS crash coverage and roadway length by state

California	1. More than 500,000 crashes occur each year; HSIS includes about 38% of those crashes. 2. HSIS includes 15,500 miles of mainline (non-ramp) roadways.
North Carolina	1. About 230,000 crashes occur each year; HSIS includes 70% of those crashes. 2. Of the 77,000 miles of roadway on the North Carolina state system, approximately 62,000 miles are included in the database.
Ohio	1. About 380,000 crashes occur each year; HSIS includes 40% of those crashes. 2. In Ohio, about 116,000 miles of highway in total; HSIS includes approximately 19,500 miles of roadway.
Washington	1. 130,000 crashes occur each year; HSIS includes 37% of those crashes. 2. HSIS contains 7,000 miles of mainline (non-ramp) roadway.

Another limitation of the HSIS data is that the dataset is not continuously updated. The HSIS data represent the final crash datasets from each state after the state has processed the crash data. As a result, the HSIS dataset may not include the last several months or more of crash data from a state. Currently, the most updated HSIS crash data are through 2009 (California is updated to 2008), so the most recent one or two years of crashes are not included in the HSIS data. Also, the oldest HSIS crash data extend back only through 2004. Limiting crash data to the period from 2004 to 2009 was a significant consideration in this research project because the large growth of on-premise digital signs is relatively recent, having mostly grown since the mid- to late 2000s. The lack of data for the last two to three years created challenges with respect to developing a robust statistical analysis procedure. For a comparison of safety impacts of a treatment (such as installation of a digital sign) to be meaningful, both the before and after analysis periods need to be about equal and as long as possible. This meant that, to have two-year analysis periods (two years before and two years after) in the safety analysis, on-premise digital signs needed to be

installed in either 2006 or 2007. In order to focus the safety analysis on the long-term impacts of on-premise digital signs, the researchers did not include the calendar year of installation of a sign in the analysis. For example, if a sign was installed in 2006, the before period was calendar years 2004 and 2005, and the after period was calendar years 2007 and 2008.

An additional limitation of the HSIS crash data is that the crash location within the HSIS is identified to the nearest 0.1 mile (528 ft) on the roadway. This required the safety analysis to be conducted for the tenth of a mile length of roadway that a sign was located within. The level of accuracy is the primary reason that 0.1 miles was chosen as the effective area of the sign.

The researchers viewed the limitations mentioned above as minor and ones that had minimal impact on the study results. There are no comparable crash datasets available to researchers that could be used for a similar type of analysis of crashes. The only alternative available to the researchers would have been to try and obtain crash data from individual agencies where on-premise digital signs have been installed. Such an approach may have provided more specific data about individual signs and site characteristics, but would have resulted in an extremely small dataset. The researchers felt that such small sample sizes would not provide sufficient robustness for statistical analysis and that the approach using the HSIS data provided greater scientific validity and robustness, as discussed in the previous chapter.

SIGN DATA

With the acquisition of the HSIS data, the research team had information to analyze crashes but had no idea about where to conduct the analysis. Determining the location for the crash analysis required information regarding the location of on-premise digital signs. Furthermore, due to the date limitations of the HSIS data, only sign sites where the sign was installed in 2006 or 2007 could be used for the crash analysis. So the research team began the process of identifying locations in California, North Carolina, Ohio, and Washington where on-premise digital signs had been installed on major roads in 2006 or 2007.

Initial attempts to identify sign locations focused upon getting information from the Signage Foundation, Inc., (SFI) research advisory panel. However, the results did not provide a large enough sample size for a robust statistical analysis. The research team began to contact sign installation companies but encountered challenges in acquiring the large amount of data needed to conduct the research. The primary challenge associated with contacting sign installation companies (which are the same companies that market the signs to individual businesses) was the proprietary nature of the business information the research team was requesting. Another challenge was the large number of individual companies that needed to be contacted to develop a robust sample size.

Because of the challenges of working with sign installation companies, the research team shifted the focus to sign-manufacturing companies. Eventually, the research team was able to work with two electronic sign-manufacturing companies to get a list of on-premise digital signs installed in any of the four study states during 2006 or 2007. Each of the two lists was converted into datasets for use in the research effort. The first dataset (dataset #1) contained 2,953 sign sites and 27 variables, which included the characteristics of signs and roads, such as sign order date, sign

address (road, county, and state), the nearest cross street and its distance from the sign, the nearby cross street with the highest volume and its distance from the subject intersection, and traffic volume on the subject road. The research team did not use the road information from dataset #1, relying instead upon the road data in the HSIS crash dataset. This ensured consistency in the approach with the different sign datasets. Also, the sign installation date was considered to be the sign order date plus two weeks. This assumption was based on input from the sign-manufacturing company. Since the entire year that the sign was installed was excluded from the analysis, this was considered not to be a critical issue.

The second dataset (dataset #2) had 63 site addresses and 10 variables. Unlike the first dataset, most variables in dataset #2 were related to product information, such as installation data, sales representative, product name, matrix, color, customer ID (address), and status of signs.

For the analysis, these two datasets were combined as one for use in analyzing the crashes by individual state. The combined dataset was further refined by removing all sign locations that were not installed in either 2006 or 2007. The calendar year that a sign was installed was treated as the construction year, and the crashes that occurred in that year were removed from the analysis. The entire calendar year was removed from the analysis due to uncertainty over the actual installation date of the sign since the data provided only the order date for the sign. Removing the entire calendar year associated with installation also eliminated the novelty effect associated with implementing a new feature. The second variable, the sign installation address, was used to select related crashes by the sign's location and default sign-effective areas. For example, the researchers defined the crashes located within 0.1 miles from the target signs as related crashes. In reality, the effective area could be larger or smaller depending upon the sign size. The procedure used for this analysis did not adjust the effective area based on sign size or other factors. Overall, significant effort was put into ensuring the accuracy of the sign datasets because the quality of the data had a huge impact on the precision and accuracy of the analysis.

DATA-MERGING PROCEDURE

The previous sections explain how the researchers obtained their study data (the sign dataset and the crash dataset) and the characteristics of each dataset. This section gives more details about the dataset-merging procedure. Several steps were involved in merging the crash and sign location datasets into a single dataset that could be used for statistical analysis. The early steps focused on confirming that the digital sign was still in place and near the road that it is related to. This was needed because a site could have an address on one road but have the sign facing traffic on another road bordering the site property. The later steps focused upon converting the street address of the sign location to a route and milepost value that could be used with the crash dataset. This complex effort was necessary due to the fact that the sign and crash datasets used different location methods. The sign dataset was based on the site address, while the crash database was based on route number and milepost. For example, a location in the sign dataset would record a location with "1234 North Highway 101, Anytown, WA 98584," but the HSIS would show the same location as "route number = 23101" and "mile post = 335.72." In order to define the related crashes that were adjusted to the target signs, the researchers needed to transfer sign locations into the HSIS location system. The basic steps are described below and illustrated in Figure 2.

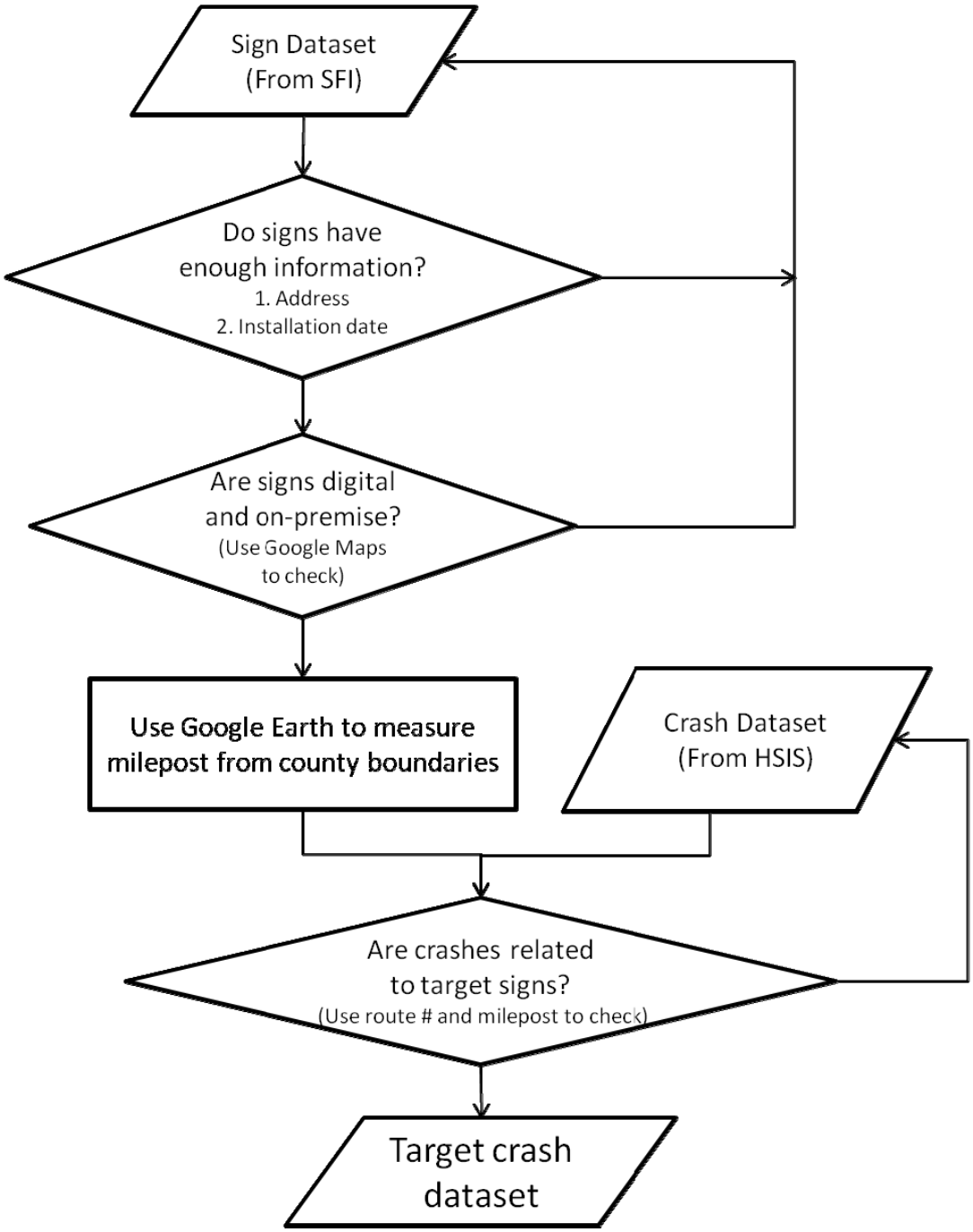

Figure 2. The flow chart for data collection and merging procedure

1. For each record of the combined sign dataset (3,016 total records), the research team evaluated the location information (typically a street address) and the sign order date. Records with missing or incomplete location information or with assumed sign installation dates that were not in 2006 or 2007 were deleted from the dataset.

2. Research team members then verified the location of the sign using the site address in the sign dataset and taking the steps listed below. Figure 3 shows an example table that the researchers used for the above data collection, including screenshots of Google Maps and Google Earth (Google Earth, 2008). Columns 1–3 are the address information given by the sign companies. Columns 4–7 are determined through Google Maps, and Columns 8–11 are determined through Google Earth.
    a. The sign was located in Google Maps using the site address.
    b. Using the Street View feature of Google Maps, a member of the research team identified the sign on the site or deleted the record with a note that the on-premise digital sign could not be identified. There were some challenges associated with finding digital signs using the Street View pictures from Google Maps, including fuzzy pictures with low resolution, which made it difficult to evaluate some signs, and digital signs that were not obvious during the daytime (Street View provides only daytime pictures).
    c. The screen image of the subject sign was saved, and basic sign characteristics were identified and/or estimated. Examples include sign color, size, and business type.
    d. An initial determination was made as to whether the sign was located on a major road that would be part of the HSIS crash dataset. If the road was not expected to be a major road, the record was deleted from the dataset.
3. The sign location was entered into Google Earth to determine the county in which the sign was located and the mileage from the county border. This included identifying the county identification code in the appropriate HSIS manual for a given state. This provided the milepost location information needed to relate the sign location to the location information in the crash dataset. Defining the milepost information required doing the following:
    a. Identifying the neighboring county, which was used to determine in which direction the mileposts were increasing.
    b. If the county had mileposts restarting at zero at the county borders, determining in which direction they were increasing, based on the number of lanes at the borders. If the direction could not be determined, a general rule of increasing from west to east or south to north was used.
    c. Using the path tool in Google Earth to measure the distance from the county border to the sign. This distance and the beginning milepost at the county border established the milepost of the sign.

An example (using the above procedure) can be founded in Appendix A. After target sign locations were transferred into the HSIS locating system, a statistics software package, "R," was used to select the related crashes among the whole HSIS dataset.

Sign ID	Address	Installation date	Google Map				Google Earth				Note
			Picture	Color (Single/ Multi.)	Dimension	Business Type	County ID	Route #	Distance	Mile post	

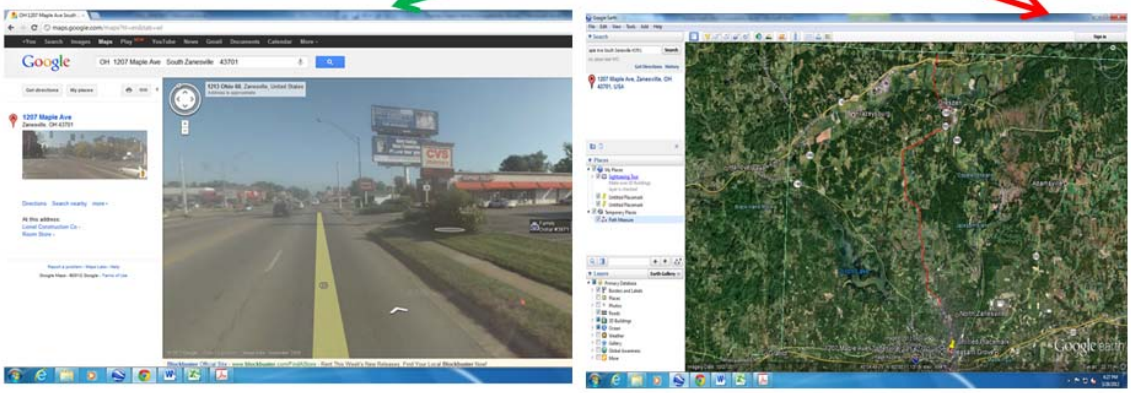

Figure 3. Example work table of site data collection

CHAPTER 4:
STUDY METHODOLOGY

Evaluating the effects of treatment on the number and severity of crashes is a very important topic in highway safety. For the last 30 years, various methods have been proposed for evaluating safety treatments (Abbess et al., 1981; Danielsson, 1986; Davis, 2000; Hauer, 1980a; Hauer, 1980b; Hauer et al., 1983; Maher and Mountain, 2009; Miranda-Moreno, 2006; Wright et al., 1988). The methods are classified under two categories: the before-after study and the cross-sectional study. In a before-after study, the safety impacts of an improvement or treatment at a given location are determined by comparing the change in crashes before and after the improvement/treatment was installed. In a cross-sectional study, crashes or crash rates on two different facilities with similar characteristics except for the improvement of interest are compared. The before-after study is typically more desirable because it provides a more direct evaluation of the safety impacts. Although they have been used by some researchers (Noland, 2003; Tarko et al., 1998), cross-sectional studies are more difficult to conduct because different facilities are rarely identical in all features except the one of interest. Hence, the cross-sectional approach was not used in this research. The before-after type of study can be further divided into several types:

- naïve before-after study,
- before-after study with control group,
- before-after study using the EB method, and
- before-after study using the full Bayes approach.

The before-after study using the full Bayes approach is a more recent development in statistical safety analysis, developed and used by several noted safety researchers (Hauer and Persaud, 1983; Hauer et al., 1983; Hauer, 1997; Li et al., 2008; Persaud and Lyon, 2007). The advantages and disadvantages for each of the above before-after methods are described in more detail in this chapter.

A BEFORE-AFTER STUDY AND A CROSS-SECTIONAL STUDY

As mentioned previously, observational crash studies can be grouped into two types: the before-after study and the cross-sectional study. The selection of the study type is based on the availability of historical crash data, traffic volume, or the comparison group. The following sections provide details about the before-after methodology.

The Before-After Study

The before-after study is a commonly used method for measuring the safety effects of a single treatment or a combination of treatments in highway safety (Hauer, 1997). Short of a controlled and full randomized study design, this type of study is deemed superior to cross-sectional studies since many attributes linked to the converted sites where the treatment (or change) was implemented remain unchanged. Although not perfect, the before-after study approach offers a

better control for estimating the effects of a treatment. In fact, as the name suggests, it implies that a change actually occurred between the "before" and "after" conditions (Hauer, 2005).

As described by Hauer (1997), the traditional before-after study can be accomplished using two tasks. The first task consists of predicting the expected number of target crashes for a specific entity (i.e., intersection, segment where an on-premise sign was installed, etc.) or series of entities in the after period, had the safety treatment not been implemented. In other words, the before-after approach described by Hauer compares the expected number of crashes in the after period with the treatment installed to the expected number of crashes in the after period had the treatment not been installed. The calculation for each expected number of crashes is based on numerous factors, including the actual number of crashes in the before condition, the actual number of crashes in the after period, and incorporation of site-specific and statistical considerations. The symbol π is used to represent the expected number of crashes in the after period (a summary of all statistical symbols used in this report are presented in Appendix B). The second task consists of estimating the number of target crashes (represented by the symbol λ) for the specific entity in the after period. The estimates of π and λ are $\hat{\pi}$ and $\hat{\lambda}$ (the caret or hat represents the estimate of an unknown value). Here, the term "after" means the time period after the implementation of a treatment; correspondingly, the term "before" refers to the time before the implementation of this treatment (an on-premise digital sign in this study). In most practical cases, either $\hat{\pi}$ or $\hat{\lambda}$ can be applied to a composite series of locations (the sum of *i*'s below) where a similar treatment was implemented at each location.

Hauer (1997) proposed a four-step process for estimating the safety effects of a treatment. The process is described as follows (see also Ye and Lord, 2009):

- Step 1: For $i = 1,\ 2,\ ...,\ n$, estimate $\lambda(i)$ and $\pi(i)$. Then, compute the summation of the estimated and predicted values for each site i, such that $\hat{\lambda} = \sum \hat{\lambda}(i)$ and $\hat{\pi} = \sum \hat{\pi}(i)$.
- Step 2: For $i = 1,\ 2,\ ...,\ n$, estimate the variance for each, $Var\{\hat{\lambda}(i)\}$ and $Var\{\hat{\pi}(i)\}$. For each single location, it is assumed that observed data (e.g., annual crash counts over a long time frame) are Poisson distributed and $\hat{\lambda}(i)$ can be approximated by the observed value in the before period. On the other hand, the calculation of $Var\{\hat{\pi}(i)\}$ will depend on the statistical methods adopted for the study (e.g., observed data in naïve studies, method of moments, regression models, or EB technique). Assuming that crash data in the before and after periods are mutually independent, then $Var\{\hat{\lambda}\} = \sum Var\{\hat{\lambda}(i)\}$ and $Var\{\hat{\pi}\} = \sum Var\{\hat{\pi}(i)\}$.
- Step 3: Estimate the parameters δ and θ, where $\hat{\delta} = \hat{\pi} - \hat{\lambda}$ (again, referring to estimated values) is defined as the reduction (or increase) in the number of target crashes between the predicted and estimated values, and $\hat{\theta} = \hat{\lambda} / \hat{\pi}$ is the ratio between these two values. When θ is less than one, the treatment results in an improvement in traffic safety, and when it is larger than one, the treatment has a negative effect on traffic safety. The term θ has also been referred to in the literature as the index of effectiveness (Persaud et al., 2001). Hauer (1997) suggests that when less than 500 crashes are used in the before-after study, θ should be corrected to remove the bias caused by the small sample size using

the following adjustment factor: $1/[1+Var\{\hat{\pi}\}/\hat{\pi}^2]$. The total number of crashes was over 500, but the adjustment factor had to be applied when subsets of the data, such as single- or multi-vehicle crashes, were analyzed.

- Step 4: Estimate the variances $Var\{\hat{\delta}\}$ and $Var\{\hat{\theta}\}$. These two variances are calculated using the following equations (note: $Var\{\hat{\theta}\}$ is also adjusted for the small sample size):
  - $Var\{\hat{\delta}\} = Var\{\hat{\lambda}\} + Var\{\hat{\pi}\}$ (Eq. 1)
  - $Var\{\hat{\theta}\} = \frac{\hat{\theta}^2[(Var\{\hat{\lambda}\}/\hat{\lambda}^2) + (Var\{\hat{\pi}\}/\hat{\pi}^2)]}{[1+(Var\{\hat{\pi}\}/\hat{\pi}^2)]^2}$ (Eq. 2)

The four-step process provides a simple way for conducting before-after studies. Three common before-after methods will be introduced in the following sections. All three methods use the same four-step process.

COMMON METHODS FOR CONDUCTING A BEFORE-AFTER STUDY

Having selected the before-after study approach, the research team then needed to decide which specific before-after method would be the most appropriate for analyzing the safety impacts of on-premise digital signs. This section of the report describes the methodologies and data needs associated with three before-after study types: naïve before-after studies, before-after studies with a CG, and the EB method.

Naïve Method

Among all the before-after methods, the naïve method is the simplest. The estimation of θ is simply equal to the ratio between the number of crashes in the after period and the number of crashes in the before period (which is used to predict the number of crashes in the after period if the treatment was not implemented). Equation 3 illustrates how the index of safety effectiveness is calculated. This method is very straightforward, but it is seldom used in the current safety study because it does not account for the RTM bias. Not including the RTM bias could overestimate the effects of the treatment or underestimate the safety impacts. The naïve method does not account for external factors that occur at the local or regional level, such as changes in weather patterns or economic conditions.

$$\hat{\theta}_{naive} = \frac{\hat{\lambda}}{\hat{\pi}} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{t} N_{ij2}^{T}}{\sum_{i=1}^{n}\sum_{j=1}^{t} N_{ij1}^{T}} \quad \text{(Eq. 3)}$$

Where

$\hat{\theta}_{naive}$ = the estimate of safety effectiveness by using the naïve method,
$\hat{\pi}$ = the predicted number of crashes for the treatment group in the after period,
$\hat{\lambda}$ = the estimated number of crashes for the treatment group in the after period,
n = the sample size,
t = the time period,

N_{ij1}^{T} = the observed response for site i (T = treatment group) and year j (in the before period), and
N_{ij2}^{T} = the observed response for site i (T = treatment group) and year j (in the after period).

The result can be adjusted when the traffic flow and time interval are different between the before and after periods. It is adjusted by modifying the predicted number of crashes as shown in Equation 4:

$$\pi = r_d r_f \sum_{i=1}^{n} \sum_{j=1}^{t} N_{ij1}^{T} \quad \text{(Eq. 4)}$$

Where
r_d = the ratio of the duration between the after and before periods, and
r_f = the ratio of the traffic flow between the after and before periods.

Control Group Method

The CG method can be used to help control for external factors. The number of crashes collected at the control sites is defined as μ (before) and ν (after). The adjusting factor, the ratio of ν to μ, is used to remove the effects caused by other external factors from π in the theorem. Equation 5 illustrates how to adjust the naïve estimate. It should be pointed out that the RTM could technically be removed if the characteristics of the control group are exactly the same as those of the treatment group. However, getting control group data with the exact same characteristics may not be possible in practice, as discussed in Kuo and Lord (2012). Collecting control group data usually adds extra cost and time compared to the naïve method since more data needs to be collected.

$$\hat{\theta}_{CG} = \frac{\hat{\lambda}}{\hat{\pi} \times \frac{\hat{\nu}}{\hat{\mu}}} = \frac{\sum_{i=1}^{n} \sum_{j=1}^{t} N_{ij2}^{T}}{\sum_{i=1}^{n} \sum_{j=1}^{t} N_{ij1}^{T} \times \sum_{i=1}^{n} \sum_{j=1}^{t} \frac{N_{ij2}^{C}}{N_{ij1}^{C}}} \quad \text{(Eq. 5)}$$

Where
$\hat{\theta}_{CG}$ = the estimate of safety effectiveness by using the control group method,
$\hat{\lambda}$ = the estimated number of crashes for the treatment group in the after period,
$\hat{\pi}$ = the predicted number of crashes for the treatment group in the after period,
$\hat{\nu}$ = the estimated number of crashes for the control group in the after period,
$\hat{\mu}$ = the estimated number of crashes for the control group in the before period,
N_{ij1}^{T}, N_{ij1}^{C} = the observed responses for site i (T = treatment group and C = control group) and year j (in the before period), and
N_{ij2}^{T}, N_{ij2}^{C} = the observed responses for site i (T = treatment group and C = control group) and year j (in the after period).

Empirical Bayes Method

The EB method is recommended in the *Highway Safety Manual* (HSM), published by the American Association of State Highway and Transportation Officials (AASHTO) and approved for use by the FHWA (AASHTO, 2010). The HSM is a recent document that defines standardized procedures for conducting safety analyses of highway safety improvements. The EB method combines short-term observed crash numbers with crash prediction model data in order to get a more accurate estimation of long-term crash mean. The EB method is used to refine the predicted value by combining information from the site under investigation and the information from sites that have the same characteristics, such as range of traffic flow, number of lanes, lane width, etc.

As an illustration, Hauer et al. (2002) use a fictional "Mr. Smith" to illustrate use of the EB method: Mr. Smith is a new driver in a city. He has no crash records during his first year of driving. Based on past crash histories for the city, a new driver in that city has 0.08 accidents per year. Based only on Mr. Smith's record, it is not reasonable to say that he will have zero accidents or have 0.08 accidents for the next year (based on the average of all new drivers but disregarding Smith's accident record). A reasonable estimate should be a mixture of these two values. Therefore, when estimating the safety of a specific road segment, the accident counts for this segment and the typical accident frequency of such roads are used together.

The index of safety effectiveness is illustrated in Equation 6. With the EB method, the analyst first estimates a regression model or safety performance function (SPF) using the data collected with the control group. Then, the model is applied to the sites where the treatment was implemented to get a preliminary predicted value for the after period. The EB method is then used to refine the estimate to account for the RTM bias and the external factors. It is possible for the EB method to be biased if the characteristics of the treatment and control groups are not the same (Lord and Kuo, 2012).

$$\hat{\theta}_{EB} = \frac{\hat{\lambda}}{\hat{\pi}} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{t} N_{ij2}^{T}}{\sum_{i=1}^{n}\sum_{j=1}^{t} M_{ij1}^{T}} \qquad \text{(Eq. 6)}$$

Where

$\hat{\theta}_{EB}$ = the estimate of safety effectiveness based on the EB method;

$\hat{\pi}$ = the predicted number of crashes for the treatment group in the after period;

$\hat{\lambda}$ = the estimated number of crashes for the treatment group in the after period;

M_{ij1} = the expected responses for site i for the EB method,

$$\mathrm{M_{ij1}} = \mathrm{W} \times (\hat{\Lambda}_1) + (1 - \mathrm{W}) \times (\sum_{\mathrm{j=1}}^{\mathrm{t}} N_{\mathrm{ij1}});$$

W = the weight for sites for the EB method, $W = \frac{1}{1 + \hat{\Lambda}_1 \times \hat{\alpha}}$;

$\hat{\Lambda}_1$ = the estimate for the average number of crashes of all sites in the before period; and

$\hat{\alpha}$ = the estimate of the dispersion parameter.

$\hat{\Lambda}_1$ and $\hat{\alpha}$ can be estimated using two different approaches (Hauer, 1997). They can be estimated based on a regression model or the method of moment. Both are calculated using data collected as part of the control group. For this research, the average number of crashes and dispersion parameter were estimated using a regression model.

CALCULATION PROCEDURES AND EXAMPLES

The EB before-after method was applied to this study with the regression models or SPFs selected from the HSM (AASHTO, 2010), which includes road types from two to five lanes. As for sites located on wider roads (six lanes and eight lanes, which are not covered in the HSM), the researchers used the SPFs from a Texas A&M Transportation Institute (TTI) study (Bonneson and Pratt, 2009). The number of crashes in each year during the before period (Λ_i) was estimated using the regression model shown in Equation 7:

$$\Lambda_i = \exp(a + bLn(AADT_i) + Ln(L_i)) \quad \text{(Eq. 7)}$$

Where
Λ_i = the estimator for the average number of crashes per year for site i,
a, b = the coefficients in the regression model,
$AADT_i$ = the average daily traffic volume for site i,
L_i = the road length for site i, and
Ln = natural logarithm.

Table 3 shows the regression coefficients (a, b) used in Equation 7 for multi- and single-vehicle crashes.

One of the sign sites in Ohio provides an example of the detailed calculation of $M_{i,EB}$. This site is on an urban 4-lane divided highway segment in Allen County. As shown in Table 3, its intercept is -12.34 for multi-vehicle crashes and -5.05 for single-vehicle crashes, while the coefficients for the AADT are 1.36 and 0.47, respectively. For the analysis used in this report, a multi-vehicle crash is one involving two or more vehicles in the same collision.

Using the EB method, the analysis procedure to get the expected number of crashes in the before period has the following steps:

1. Identify the route number and milepost by the site's address. More specifically, the address of the example site is "1234 ABC St, Name of City, Allen County, OH." Follow the data analysis procedures discussed in Chapter 3 to identify that the route number is 657676309 and the milepost is 7.58.

Table 3. Coefficients for multi and single-vehicle crash regression model

Crash Type	Road Type*	Regression Coefficients		Dispersion Parameter (α)
		Intercept (a)	AADT (b)	
Multi-vehicle	2U	−15.22	1.68	0.84
	3T	−12.4	1.41	0.66
	4U	−11.63	1.33	1.01
	4D	−12.34	1.36	1.32
	5T	−9.7	1.17	0.81
Single-vehicle	2U	−5.47	0.56	0.81
	3T	−5.74	0.54	1.37
	4U	−7.99	0.81	0.91
	4D	−5.05	0.47	0.86
	5T	−4.82	0.54	0.52

Note: *U = undivided road, T = road with two-way left turn lane, D = divided road.

2. Based on the route number and milepost obtained above, use R statistical software to select the related crashes and road files from the HSIS dataset, which includes (1) the observed crashes near the target sign site, (2) the observed crashes in the control group sites (10 sites, which are adjusted to the target sign site on the same road), and (3) the target road file, such as traffic volume, the number of lanes, and median type. For example, the number of observed crashes at the example site is 1 in 2004, and the crash counts of the related 10 control group sites are 0, 0, 1, 1, 0, 0, 0, 0, 1, and 1. The AADT of the site is 19,753 (vehicles/day), and it has four lanes.
3. Use Equation 9 to predict the crash number of the example site:

$$\hat{\Lambda}_{2004} = \exp(a + b(Ln(AADT)) + Ln(L)$$

$$\hat{\Lambda}_{2004,\text{multi}} = \exp(-12.34 + 1.36 \times Ln(19753) + Ln(0.2)) = 0.61$$

$$\hat{\Lambda}_{2004,\text{single}} = \exp(-5.05 + 0.47 \times Ln(19753) + Ln(0.2)) = 0.13$$

$$\hat{\Lambda}_{2004} = \hat{\Lambda}_{2004,\text{multi}} + \hat{\Lambda}_{2004,\text{single}} = 0.74 \text{ (crashes/year)}$$

   The estimated crash counts of the site and its control group sites are 0.74 and 6.64, respectively (the estimated multi-and single crash counts of its control group are 5.36 and 1.28).
4. Due to using the SPFs from the HSM instead of the local SPFs from any existing studies conducted in the same study area, it is necessary to multiply the results by a calibration factor to adjust the prediction value (refer to Appendix A in the HSM for more details). The calibration factor of single-vehicle crashes at the example site in 2004 is 3.13, which is equal to the ratio of observed crashes in the control group divided by the predicted crash number in the control group (3.13 = (1×4+0×6)/1.28). By multiplying the above calibration factor, the final crash number estimation for the example site in 2004 should be 0.42 (=0.13×3.13). A calibration factor was calculated for each site and each year included in the study.

5. Repeat steps 3 and 4 to get the final prediction crash number for the example site for each year in the before period. By doing so, the estimated multi- and single-vehicle crash counts of the site in 2005 are 4.65 and 0.21, respectively. Using the summary of this prediction crash number and dispersion parameter (obtained from Table 3) results in the weights (W) for this site for the multi- and single-vehicle crashes, which are 0.07 and 0.65, respectively:

$$W = \frac{1}{1 + \hat{\Lambda}_1 \times \hat{\alpha}}$$

$$W_{multi} = \frac{1}{1 + (5.43 + 4.65) \times 1.32} = \frac{1}{1 + 10.08 \times 1.32} = 0.07,$$

$$W_{\text{single}} = \frac{1}{1 + (0.42 + 0.21) \times 0.86} = \frac{1}{1 + 0.63 \times 0.86} = 0.65$$

6. Because traffic volume and other explanatory variables may change between the before and after periods, the researchers used one factor to account for this difference. The crash counts of the example site in 2007 and 2008 can be estimated by repeating steps 3 and 4. The estimated multi- and single-vehicle crash counts of the site in the after period are 0.84 and 0.67, respectively. Factors are estimated by:

$$r = \hat{\Lambda}_{after} \Big/ \hat{\Lambda}_{before}$$

$$r_{i,multi} = (12.76 / 3) / (10.08 / 2) = 0.84$$

$$r_{\text{i,single}} = (0.63 / 3) \big/ (0.63 / 2) = 0.67$$

Also, if the time periods (Y) of the before and after periods are different, one factor is needed to adjusted it. Here, the before and after period are both two years:

$$t_i = Y_{i,after} \big/ Y_{i,before} = 3 / 2 = 1.5$$

7. Using the EB method, the expected total number of crashes that would occur during the after period had the on-premise digital sign not been installed was 2.63:

$$\mathrm{M}_{\text{i,EB}} = \left[\mathrm{W} \times (\hat{\Lambda}_1) + (1 - \mathrm{W}) \times (\sum_{\text{j=1}}^{\text{t}} N_{\text{ij1}}) \right] \times r_i \times t_i$$

$$\mathrm{M}_{\text{i,multi,EB}} = \left[0.07 \times 10.08 + (1 - 0.07) \times 0 \right] \times 0.84 \times 1.5 = 1.14$$

$$\mathrm{M}_{\text{i,single,EB}} = \left[0.65 \times 0.63 + (1 - 0.65) \times 3 \right] \times 0.67 \times 1.5 = 1.49$$

$$\mathrm{M}_{\text{i,all,EB}} = 1.14 + 1.49 = 2.63$$

8. The variance of the EB estimate at the example site is calculated by:

$$\mathrm{Var}(\mathrm{M}_{\text{1,EB}}) = (1 - \mathrm{W}) \times \mathrm{M}_{1,EB} \times r_i \times t_i$$

$$\mathrm{Var}(\mathrm{M}_{\text{1,multi,EB}}) = (1 - 0.07) \times 1.14 \times 0.84 \times 1.5 = 1.31$$

$$\mathrm{Var}(\mathrm{M}_{\text{1,single,EB}}) = (1 - 0.65) \times 1.49 \times 0.67 \times 1.5 = 0.54$$

$$\mathrm{Var}(\mathrm{M}_{\text{1,all,EB}}) = 1.31 + 0.54 = 1.85$$

9. The safety index of the example site is:

$$\hat{\theta}_{EB} = \frac{\hat{\lambda}}{\hat{\pi}} = \frac{\sum_{i=1}^{n} \sum_{j=1}^{t} N_{ij2}^{T}}{\sum_{i=1}^{n} \sum_{j=1}^{t} M_{ij1}^{T}} = \frac{9}{2.63} = 3.43$$

10. The 95 percent confidence interval of the example site is given as.

$$\hat{\theta} \pm Z_{0.25}\sqrt{Var\left(M_{1,EB}\right)} = \left[3.43 \pm 1.96 \times \sqrt{1.85}\right] = \left[0.76, 6.10\right]$$

The same method was applied to other locations using the appropriate SPFs. The next chapter provides the final results of the completed safety analysis.

CHAPTER 5:
RESULTS

The previous chapter explained why the research team chose to use the EB analysis procedure and provided an example of how the EB analysis was conducted. The first section of this chapter provides the results of the before-after study for each state and all the states combined. The second section provides more details about how digital on-premise signs impact traffic safety for multi-vehicle and single-vehicle crashes. The third section provides a description of an analysis of variance of the means of the safety index (θ) among the different sign characteristics such as sign color, sign size, and type of business.

INDIVIDUAL AND COMBINED RESULTS

As described in Chapter 3, the research team acquired the sign dataset from sign manufacturers. However, many signs were excluded from the analysis because of missing information in the dataset provided by the sign manufacturers or limitations in the HSIS crash dataset. The researchers retained only sign sites satisfying the following conditions:

1. the sign was located in Washington, North Carolina, Ohio, or California;
2. the sign was installed in 2006 or 2007 in order to have adequate time in both the before and after analysis periods to compare crash histories; and
3. the sign was located on a major road because the HSIS crash dataset usually does not include crashes that are located on minor roads or private driveways.

Table 4 shows the progression in sample sizes based on sites meeting the conditions identified above. For example, the original dataset for Washington included 413 site addresses that might have an on-premise digital sign. In order to make sure there was an adequate before-after crash data period for further analysis, the researchers had to filter these site addresses. The first filter excluded sites where the sign was not installed in 2006 or 2007, which was needed so that there was adequate time before and after the sign was installed to perform the safety analysis. About 40 percent of the Washington sites (159 sites) met this criterion. Then, the research team used the Street View function in Google Maps to double-check whether a digital sign was present at the given addresses and whether the sign was on a major road since the HSIS crash dataset only included crashes on major roads. Only 33 sites fit this criterion. The result was that in Washington, the research team was able to use about 33 of the 400 original sites, giving an 8.0 percent yield on the raw data.

Chapter 3 mentions that the main advantage of this study is the large sample size of data and advanced statistical methods that provide more accurate results than in similar studies. Figure 4 shows the sample size of this study in relation to other published papers and reports. This study has 135 sites from four states, a number much higher than the sample size of other similar studies. Hence, the results of this study are more robust and accurate.

Table 4. Sign site sample size yield

Number of Sites	California	North Carolina	Ohio	Washington	All States
Included in original list from sign manufacturers	86	249	372	413	1,120
Sign installation time between 2006–2007	27	94	178	159	458
Digital signs & located on major roads	6	40	73	34	153
With HSIS crash data (all crashes)	6	33	63	33	135
Data yield rate	7.0%	13.3%	16.9%	8.0%	12.1%
With HSIS crash data (multiple-vehicle crashes)	6	31	61	33	131
With HSIS crash data (single-vehicle crashes)	6	32	63	33	134

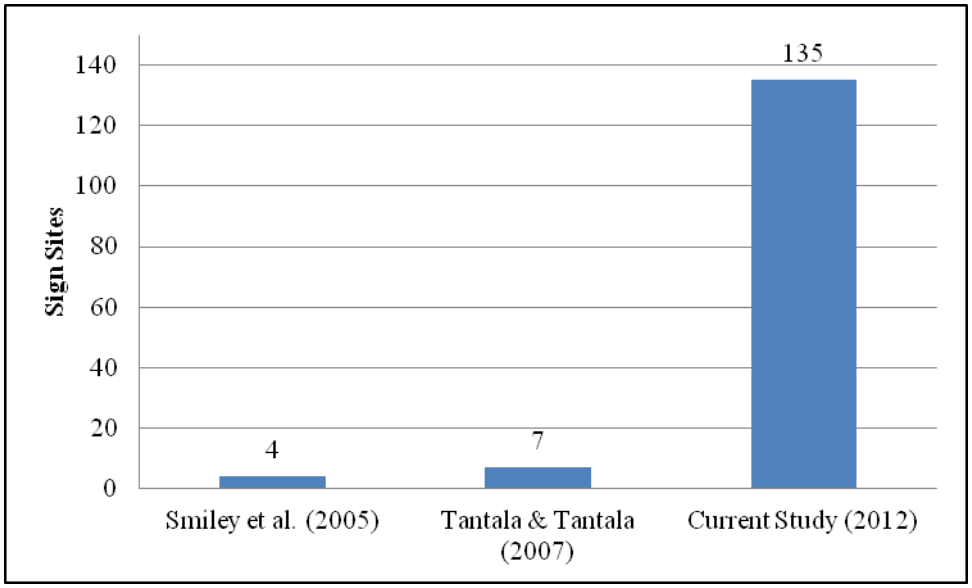

Figure 4. A comparison of sample sizes from similar studies

Table 5 presents the before-after results from the EB and the naïve statistical analysis methods. The naïve method results are provided only for comparison purposes as the naïve analysis method does not provide as meaningful results as the EB method. The results are also presented graphically in Figure 5. A safety effectiveness index (θ) of 1.0 indicates that there was no change in crashes between the before and after conditions. An index greater than 1.00 indicates that there was an increase in crash frequency in the after condition, while a value less than 1.00 indicates a decrease in crash frequency. The upper and lower bounds indicate the limits of statistical significance. If the value for θ is between the upper and lower bounds, then the change in crashes is not statistically significant at a 95 percent confidence level. A larger sample size usually leads to a smaller difference between the upper and lower bounds, but this may not always be the case since it is also governed by the variability observed in the data.

Table 5. Results of statistical analysis of before-after crash condition

State	EB Method			Naïve Method		
	Lower Bound	θ	Upper Bound	Lower Bound	θ	Upper Bound
California	0.00	1.25	2.53	0.28	0.85	1.41
North Carolina	0.87	1.14	1.41	0.88	1.13	1.39
Ohio	0.89	0.97	1.05	0.95	1.05	1.15
Washington	0.88	1.01	1.15	0.79	0.90	1.01
All states*	0.93	1.00	1.07	0.93	1.00	1.07

Notes: *"All states" represents the combined data of the four states.
Naïve method values provided for comparison purposes only.

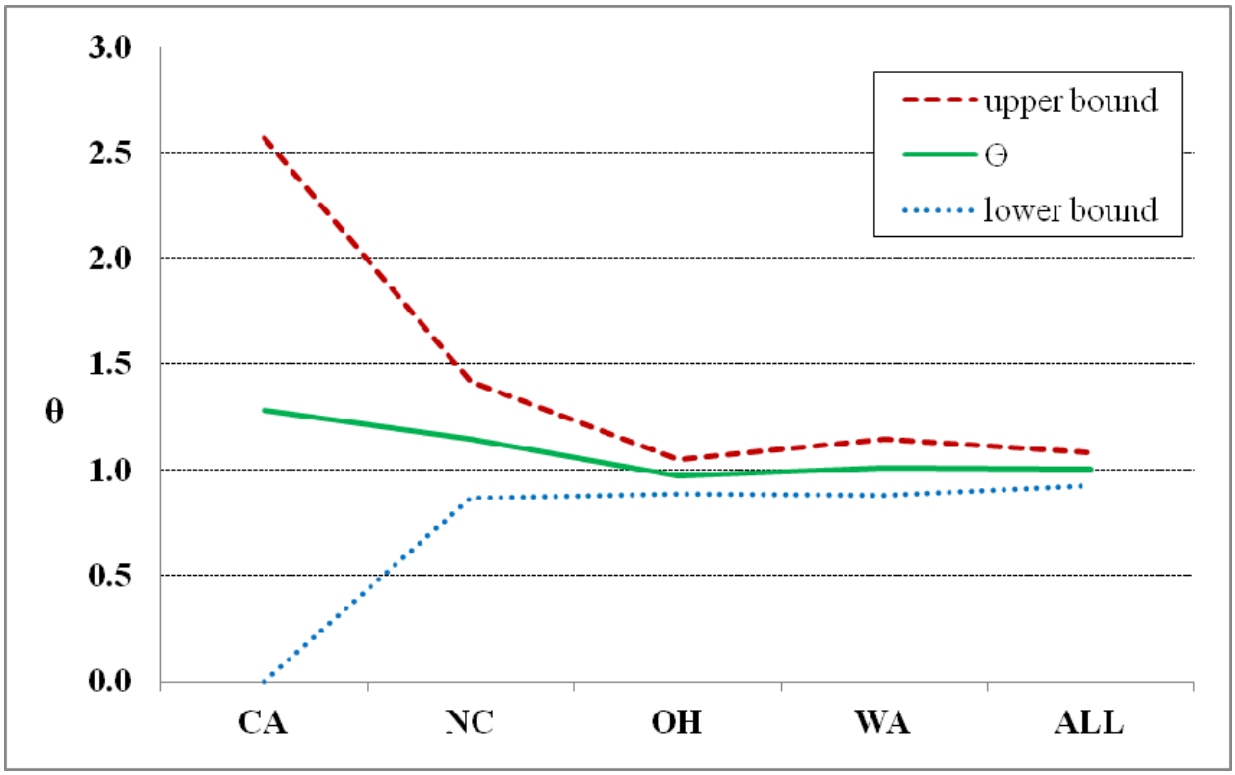

Figure 5. The safety effectiveness index and the 95 percent confidence interval for each state (all crash types)

The overall results show that there is no statistically significant increase in crash frequency after installing the on-premise digital sign because the safety effectiveness index (θ) for the entire dataset (all states) is 1.00, and the 95 percent confidence interval is 0.93–1.07 (which includes the index value of 1.00). The results for individual states are similar: no statistically significant safety impacts were observed after the installation of digital signs. In addition, one can see the width of the 95 percent confidence interval is largest for the California data. This is due to the variability of the California data and the small size of the sample set (only 6 sites). Comparing the width of the confidence intervals, from the widest to narrowest, the order is California > North Carolina > Washington > Ohio > All States.

RESULTS FOR CRASHES RELATED TO MULTIPLE AND SINGLE VEHICLES

The next analysis effort evaluated the possible safety impacts of on-premise digital signs on different types of crashes. There are several common methods to group crashes into different categories, such as the number of related vehicles, the injury levels, the collision types, and so on. Such groupings may provide some insight into the safety impacts of specific crash types, but the estimated impacts might not be precise because of a smaller sample size.

The additional analysis separated crashes into two subgroups: single- and multi-vehicle crashes. All calculations and notations were the same as used previously. By using the EB method to analyze crash data related to multiple vehicles, the researchers determined that the safety effectiveness index is equal to 1.00 for all states, and the 95 percent confidence interval varies between 0.96 and 1.21. Because the confidence interval of the safety effectiveness includes 1.00, there is no statistically significant change in crash frequency after installing the on-premise digital sign. Figure 6 graphically illustrates the results for multi-vehicle crashes. The 95 percent confidence intervals are slightly larger in this figure than in Figure 5.

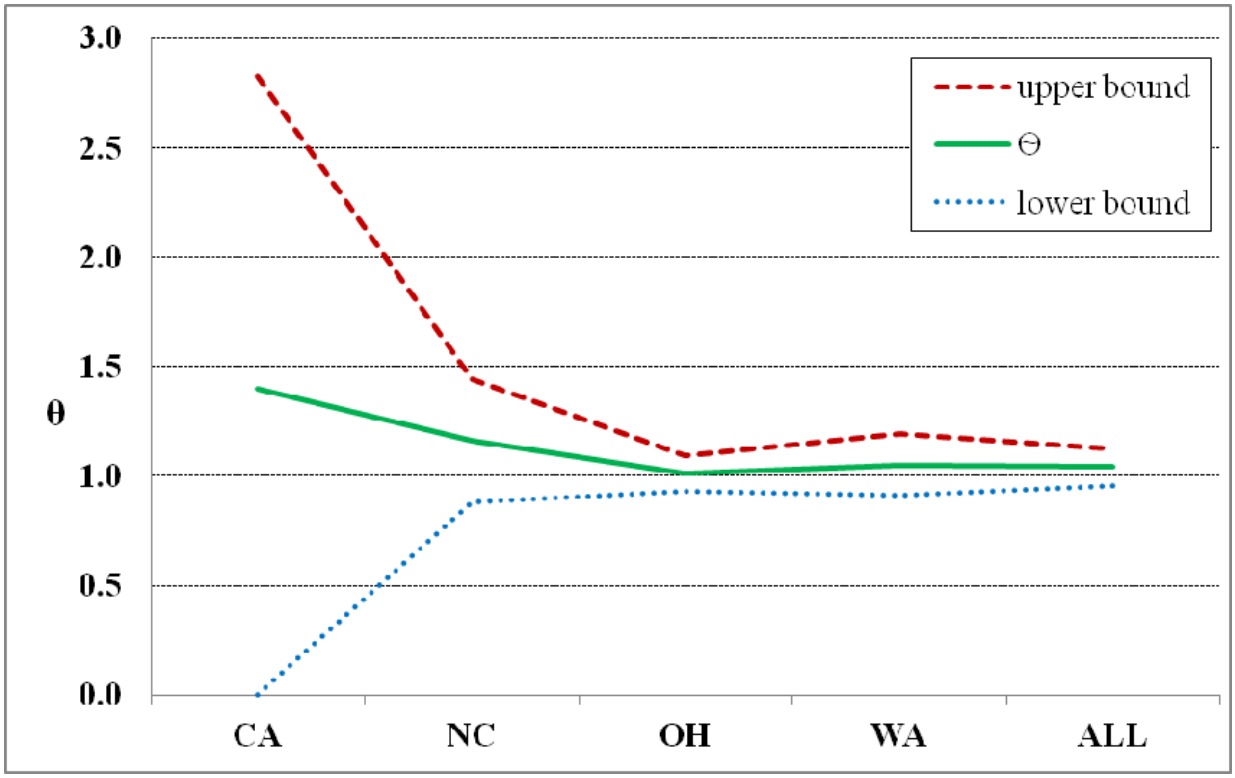

Figure 6. The safety effectiveness index and the 95 percent confidence interval for each state (multi-vehicle crashes)

The results for single-vehicle crashes are presented in Figure 7. The overall results are the similar: there are no statistically significant safety impacts from digital signs, except for California. The California results for single-vehicle crashes indicate a statistically significant decrease in crash frequency in the after period. Although the before-after results of California show a decrease in the after period, it does not affect the overall result because the low sample

size (6 sites) makes it more difficult to establish statistical significance in the analysis results. It is also worth noting that the North Carolina data has the largest confidence interval, due to the variability in the North Carolina single-vehicle crash data.

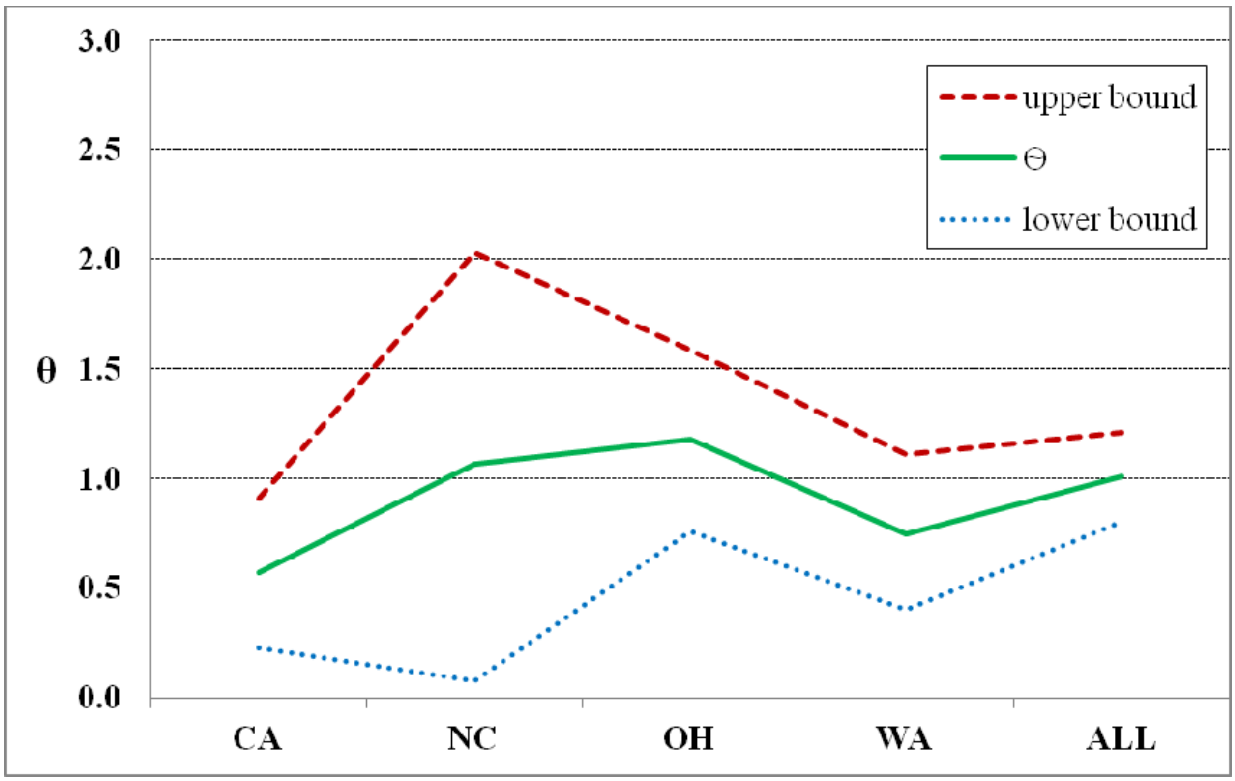

Figure 7. The safety effectiveness index and the 95 percent confidence interval for each state (single-vehicle crashes)

RESULTS FOR CRASHES RELATED TO DIFFERENT TYPES OF SIGNS

The research team also conducted an analysis to investigate the impacts of specific on-premise digital sign characteristics on the safety impacts of those signs. Specific sign characteristics that the research team evaluated included color (single or multi-color), size (small, medium, or large), and type of business. The research team used the analysis of variance (ANOVA) analysis method to evaluate whether the means of the safety index (θ) among the different characteristics of signs are equal.

An ANOVA is one of the most common statistical methods used to compare two or more means in the analysis of experimental data. In short, ANOVA provides a statistical test of whether or not the means of multiple groups are all equal, while a t-test is suitable only for the two-group case because doing multiple two-sample t-tests would increase the risk of a Type I error (for datasets containing more than 30 observations). In addition, when there are only two means to compare, the t-test and the ANOVA are equivalent. As a result, the research team chose the one-way ANOVA as the study tool to simplify the methodology, although some digital sign characteristics, such as sign color, have only two subgroups (i.e., single color and multi-color).

The theory of an ANOVA test is to separate the total variation in the data into a portion due to random error (sum of squares for error [SSE]) and portions due to the treatment (total sum of squares [SST]). Table 6 shows the typical form of a one-way ANOVA table. If the calculated F value (= treatment mean square [MST] / error mean square [MSE]) is significantly larger than F (k-1, N-k), the null hypothesis is rejected. F (k-1, N-k) is the critical value when the means of each group are equal. Most statistic software will also provide the corresponding p-value for researchers making their decisions in different confidence intervals.

Table 6. The typical form of a one-way ANOVA table

Source	SS	DF	MS	F	P(>F)
Treatments	SST	k-1	SST / (k-1)	MST/MSE	
Error	SSE	N-k	SSE / (N-k)		
Total (corrected)	SS	N-1			

Notes: *SS* = sum of squares, *DF* = degrees of freedom, *MS* = mean of sum of squares, *F* = F-distribution (because the test statistic is the ratio of two scaled sums of squares, each of which follows a scaled chi-squared distribution), *P(>F)* = the p-value when the F value (= MST/MSE) is larger than F (k-1, N-k), *k* = number of treatments, and *N* = total number of cases.

There are three data assumptions for applying the ANOVA method:

1. Independence: The study data are independently, identically, and normally distributed.
2. Normality: The distributions of the data or the residuals are normal. This assumption is true when the sample size is larger than 30.
3. Homogeneity of variability: Equality of variances — the variance of data between groups — should be the same.

If the above conditions do not exist, the ANOVA results may not be reliable. However, if the sample size of each group is similar, one can usually ignore independence and homogeneity problems. Or statisticians may transform data (such as into the logarithmic form) to satisfy these assumptions of the ANOVA.

Based on the existing sign dataset, the research team focused on three digital sign characteristics: color (single color or multi-color), sign dimension (small, medium, or large), and business type (restaurants, pharmacies and retail stores, hotels, gas stations, auto shops, or others). The definitions of sign dimension level are based on the balance principle (making the sample size of each group equal). Figure 8 shows the distribution of signs as a function of different dimensions, and the research team defined signs with an area less than 10 ft^2 as small signs. The medium sign size had an area of at least 10 ft^2 but no more than 15 ft^2, and the large sign size had an area greater than 15 ft^2. The sign size represents the area of the electronic display, not the overall size of the complete sign. It was estimated from the Street View image in Google Maps and may not be an accurate assessment of the sign dimensions.

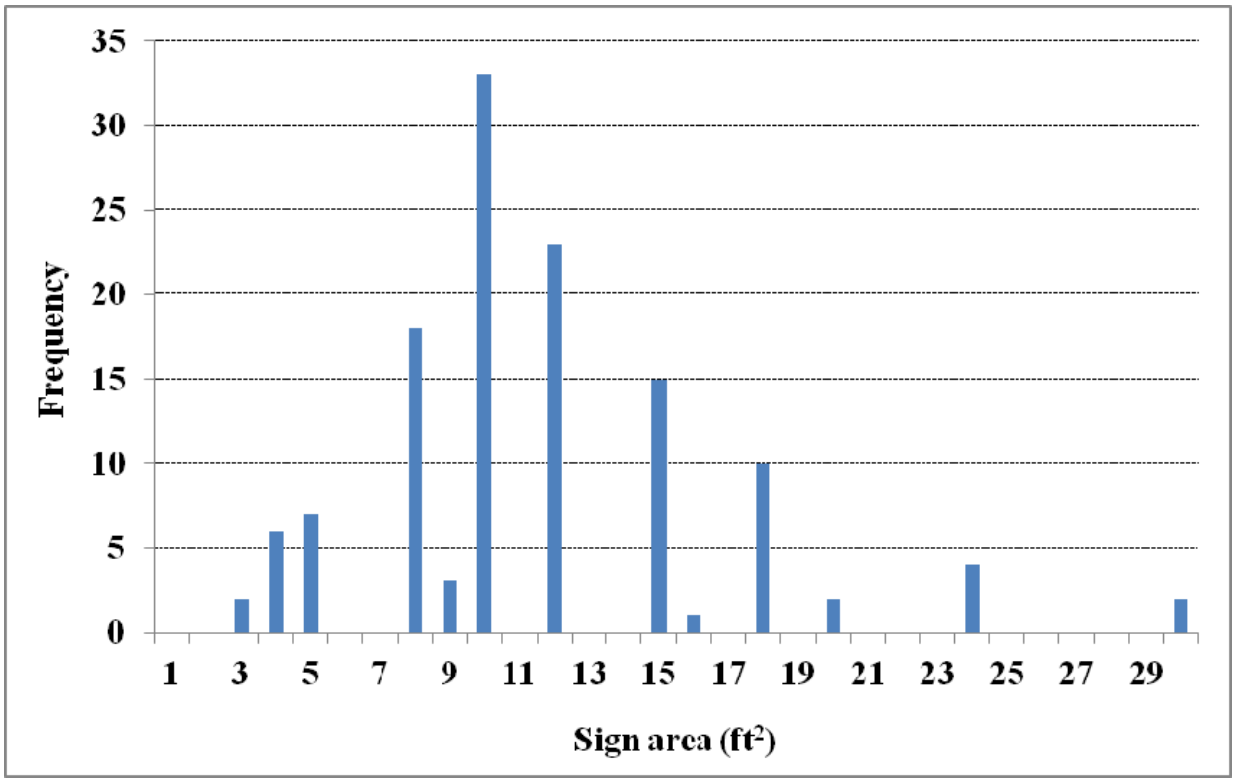

Figure 8. The histogram of digital signs for each sign dimension

Using the ANOVA method to analyze crash data related to specific design characteristics of the sign led to the conclusion that there is no statistically significant difference among the population means of the safety effectiveness index. The following descriptions provide more detail for each of the digital sign characteristics:

- **Color:** According to images obtained from the Street View feature of Google Maps, 89 signs are single-color signs, and 37 signs are multi-colored signs. Table 7 shows the ANOVA results. The test statistic (F value) is 2.07, and its p-value is 0.1527. Because the probability is larger than the critical value (0.05 for 95 percent confidence interval), the null hypothesis of equal population means cannot be rejected. In other words, the ANOVA table shows no significant difference between the mean of safety index (θ_{EB} = crash mean in the before period/crash mean in the after period) among signs having a single color or multiple colors.

Table 7. Analysis of variance table (color)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	4.464	4.4640	2.0704	0.1527
Residuals	124	267.352	2.1561		

- **Sign dimensions:** In the final sign dataset, 36 signs have a sign area less than 10 ft^2, 56 signs have a sign area 10–15 ft^2, and 34 signs have a sign area greater than 15 ft^2. In Table 8, the F value is 0.7767, and its p-value is 0.4622. Because the probability is larger

than the critical value (0.05 for 95 percent confidence interval), the null hypothesis of equal population means cannot be rejected. Accordingly, researchers conclude that there is no (statistically) significant difference among the population means.

Table 8. Analysis of variance table (sign dimension)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	2	3.39	1.6950	0.7767	0.4622
Residuals	123	268.43	2.1823		

- **Business type:** In the final sign dataset, 7 signs are for restaurants, 18 for pharmacies and retail stores, 3 for hotels, 3 for gas stations, 7 for auto shops, and 84 for other business types. Based on Table 9, the F value is 0.5401, and its p-value is 0.7455. As with the above types, the null hypothesis of equal population means cannot be rejected because the p-value is much larger than the critical value (0.05). The sample size of some business type groups is less than 30, so the research team combined all categories of business types with less than 20 samples into one large group, the "other" category. The resulting ANOVA analysis (Table 10) provides similar results: there is no significant difference among the population means.

Table 9. Analysis of variance table (six business types)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	5	5.983	1.1966	0.5401	0.7455
Residuals	120	265.833	2.2153		

Table 10. Analysis of variance table (two business types)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	0.728	0.7289	0.333	0.5649
Residuals	123	271.088	2.18619		

IMPACT OF SIGN HOLD TIME

As an additional effort for this research effort, the research team worked with members of the SFI advisory panel to identify the potential impact of hold time on the relationship between on-premise digital signs and traffic safety. One of the advantages of digital signs is the ability to change the displayed message. The minimum length of time that a message must be displayed is often an element of local sign codes because some believe that frequent changing of sign messages can increase driver distraction and lead to increased crashes. Because the researchers were working with a large number of individual sites and crash records for the after period that spanned two years, it was not possible within the available resources of this project to determine what message(s) were displayed at the time of a crash or the hold time used at a particular site at the time of a crash.

As a surrogate for including hold times as part of the individual site characteristics, the research team acquired information for the hold time regulations in the jurisdictions where the signs were

located. The 135 sign sites were located in 108 jurisdictions. A member of the SFI advisory panel contacted these jurisdictions and was able to identify hold time regulations for 66 of them. The hold time regulations of these 66 jurisdictions are summarized in Table 11. Input from the advisory panel indicated that when a jurisdiction has no statutory language regarding digital sign hold times, it most often means that sign users are able to program their sign to change messages as often as they see fit. In some cases, it could mean that the state standard for digital signs applies, which ranges from 6 to 8 seconds in the four states included in the analysis.

Table 11. Summary of sign hold times

Minimum Hold Time	Number of Jurisdictions
2–6 seconds	14
7–10 seconds	12
20 seconds	3
1–60 minutes	2
24 hours	2
Variance required*	4
No specific restriction	29
Total	66

* Hold times were established by variance on a case-by-case basis.

CHAPTER 6:
SUMMARY AND CONCLUSIONS

While there have been significant amounts of research devoted to the safety impacts of geometric design features and other aspects of the publicly owned transportation infrastructure, the same cannot be said about research on the safety impacts of privately owned signs that are directed to users of public roads. This research effort focused on addressing the safety impacts of on-premise digital signs. Previous research by others has documented the safety effects of on- and off-premise digital signs and their potential influence on crash risk to some extent. However, the results of recent crash studies are not consistent, and most studies have some important weaknesses, such as neglecting biases related to the regression-to-the-mean effects, low statistical power, and analysis results based on erroneous assumptions. In addition, Molino et al. (2009) report that the results from these studies are not comparable because of their different study methods, statistical powers, and cares of execution, which affected the quality of the research.

The research effort described in this report examined the safety impacts of on-premise digital signs using a large sample size of data and advanced statistical methods that provide more accurate results than previous studies. With the help of sign data provided by sign-manufacturing companies and crash data obtained from the Federal Highway Administration Highway Safety Information System, the research team obtained extensive datasets for signs and crashes in four states. The research team began the safety analysis with 1,120 potential study sites, but only 135 sites were usable due to limitations related to the individual signs or the related crash data. Although the yield of usable data was only 11.3 percent, the final sample size of 135 sites was much higher than the sample size of other published papers and reports related to on- and off-premise signs, indicating the results of this research are more robust and accurate.

The research team used the empirical Bayes (EB) statistical analysis method, which is the method recommended in the *Highway Safety Manual*, to conduct the safety analysis described in this report. The *Highway Safety Manual* is a recently published document that is recognized within the transportation profession as the authoritative document for analyzing the safety impacts of various transportation improvements or treatments. The EB analysis procedure uses a before-after approach, with the before and after values modified to address local safety characteristics, regression to the mean, and other factors. The EB method reports the safety impacts through the use of a safety index indicator (represented by θ). A value greater than 1 indicates an increase in crashes, and a value less than 1 indicates a decrease in crashes from the before to the after period. However, for the results to be statistically significant, the θ value must be outside the limits of the 95 percentile confidence interval.

For the entire sample size of 135 sites, the results from the EB method show that there is no statistically significant change in crash frequency associated with installing on-premise digital signs because the safety effectiveness index (θ) is determined to be 1.00, and the 95 percent confidence interval is equal to 0.93 to 1.07 (which includes 1.00, indicating no statistically significant change). The research team also conducted the analysis for each of the four individual states and obtained the same results: there are no statistically significant safety impacts from

installing on-premise digital signs. In addition, the researchers analyzed the safety impacts related to both single- and multi-vehicle crashes. The results for these analyses were also the same: there is no statistically significant increase in crashes associated with the installation of on-premise digital signs. Chapter 5 includes plots that illustrate the safety index values and confidence intervals for all of these results. As a final analysis, the research team performed an ANOVA to evaluate whether the means of the safety index (θ) varied as a function of sign factors (color, size, and type of business). The color analysis evaluated whether there was a difference in the means of the safety index for single- and multi-colored signs, and the results did not find a difference. The size analysis divided the signs in the study into three categories (<10 ft^2, 10–15 ft^2, and >15 ft^2), and the results did not find a difference. Signs were also categorized by the type of business (restaurants, pharmacies and retail stores, hotels, gas stations, auto shops, and others). Once again, there were no differences in the means. Overall, the ANOVA analysis did not identify any factor that led to an increase or decrease in traffic safety for the subcategories evaluated in the ANOVA.

Based on the analysis performed for this research effort, the authors are able to conclude that there is no statistically significant evidence that the installation of on-premise signs at the locations evaluated in this research led to an increase in crashes.

CHAPTER 7:
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APPENDIX A:
STEP-BY-STEP INSTRUCTIONS FOR STUDENTS TO RECORD SIGN DATA

1. Open one SFI sign dataset (e.g., "Washington_2006-2007.xls"). This dataset includes about 150 signs located in the state of Washington during 2006–2007.
2. Input the address information (such as Primary Street Address, City, ZIP Code, County Name, and State) of each sign in Google Maps and use the Street View function to identify the target signs. Please see this link, http://maps.google.com/help/maps/starthere/index.html#streetview&utm_campaign=en&utm_medium=et&utm_source=en-et-na-us-gns-svn&utm_term=gallery, for a demo about how to use the Street View. If you did not find any on-premise digital signs near this site, please make a note in Table 12. Check the characteristics of each sign (including colors, dimensions, and business types) and fill out Table 12. Then, use the "Print Screen" button to copy each sign's picture, and paste it in this document (such as Figure 9). The different business types are classified as (1) Restaurant, (2) Pharmacy and Retail Store, (3) Hotel, (4) Gas Station, (5) Auto Shop, and (6) Other.

Table 12. Example work table of site data collection procedure

Sign ID	Address	Installation Date	Google Maps				Google Earth				Note
			Picture	Color (Single/ Multi.)	Dimension (Estimated)	Business Type	County ID	Route #	Distance	Mile-post	
79016	19330 N US HIGHWAY 101 Shelton 98584 Mason County, WA	2006/9/15	Fig 2	S	3 ft × 6 ft	6	Mason (23)	101	19.3	335.72	

3. Then, use Google Earth to determine the county and route number, and to measure the distance between the closet county boundaries and sign location along the route (recorded in the distance column). The corresponding ID for county and route number is based on the HSIS data manual (file name: guidebook_WA[1].pdf). Then, estimate the milepost value of the sign by the distance and the milepost of the route in the boundaries (based on the HSIS road file, such as wa04road.xls). Take Figure 10; for example, the end mile point of Highway 101 in the county boundary is 355.18, and the distance between the sign and the county boundary is 19.3; so, the milepost of our sign is 335.72. Generally, the milepost value increases from south to north and from west to east. However, the best way to check it is to compare the value of the milepost of adjusted counties. For example, the milepost of US 101 in Mason County is 313.96~355.18, and the milepost of US 101 in Thurston County (located south of Mason) is 355.18~365.56. So, it is known that the mileposts increase from north to south in Mason County. The above variables will be used in the R software to select target crashes from HSIS crash datasets.
4. Write down any questions or comments in the note column. Feel free to ask us if you have any questions.

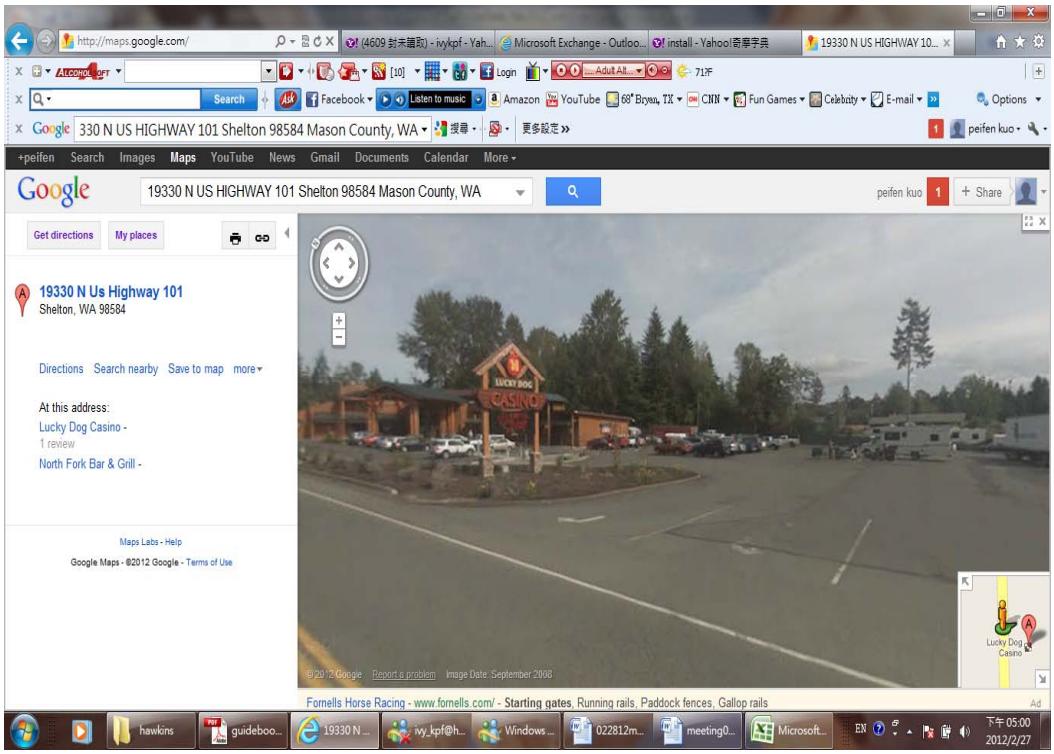


Figure 9. Example screenshot of Google Maps

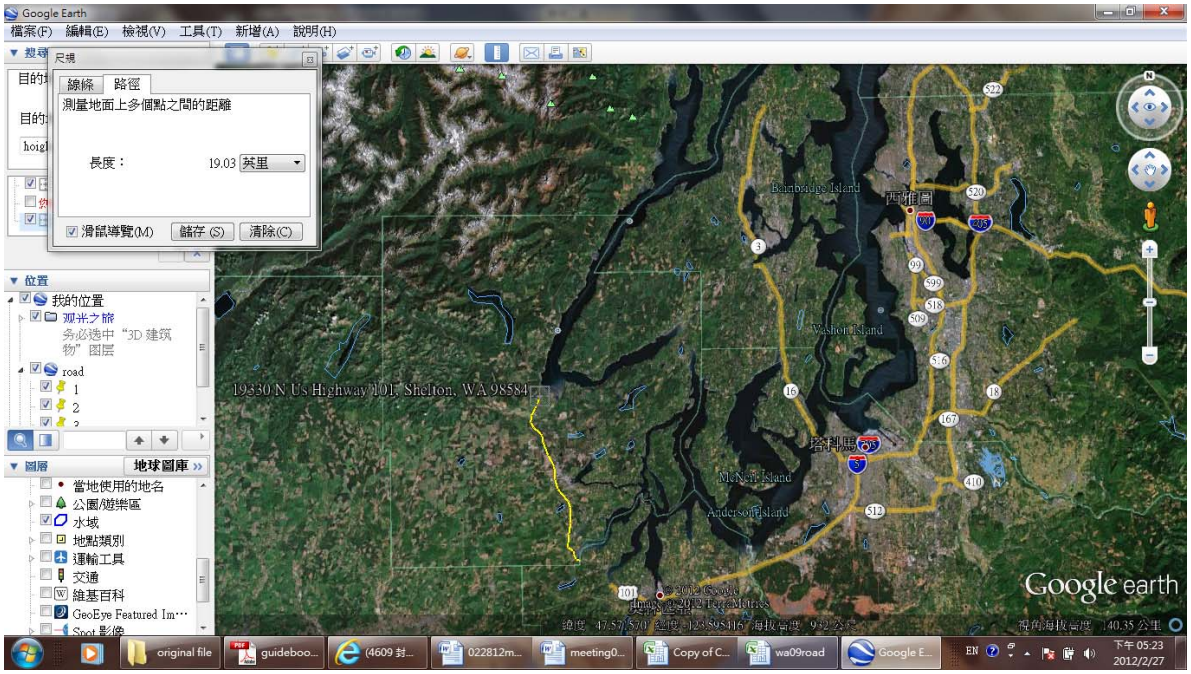


Figure 10. Example screenshot of Google Earth

APPENDIX B:
STATISTICAL SYMBOLS

The following statistical symbols are used throughout this report.

θ = the safety effectiveness, $0 < \theta \leq 1$ (can be theoretically higher, but not in this study).
n = the sample size.
α = the dispersion parameter (of the negative binomial model).
t = the time period.
$\hat{\theta}_{CS}$ = the estimate of safety effectiveness by using the CS method.
$\hat{\theta}_{naive}$ = the estimate of safety effectiveness by using the naïve method.
$\hat{\theta}_{CG}$ = the estimate of safety effectiveness by using the control group method.
$\hat{\theta}_{EB}$ = the estimate of safety effectiveness by using the EB method.
$\hat{\lambda}$ = the estimated number of crashes for the treatment group in the after period.
$\hat{\pi}$ = the estimated number of crashes for the treatment group in the before period.
$\hat{\nu}$ = the estimated number of crashes for the control group in the after period.
$\hat{\mu}$ = the estimated number of crashes for the control group in the before period.
N_{ij1}^{T}, N_{ij1}^{C} = the observed responses for site i (T = treatment group and C = control group) and year j (in the before period).
N_{ij2}^{T}, N_{ij2}^{C} = the observed responses for site i (T = treatment group and C = control group) and year j (in the after period).
M_{ij1} = the expected responses for site i for the EB method,

$$\mathrm{M_{ij1}} = \mathrm{W} \times (\hat{\Lambda}_1) + (1 - \mathrm{W}) \times (\sum_{\mathrm{j=1}}^{\mathrm{t}} N_{\mathrm{ij1}}) \quad .$$

W = the weight for sites for the EB method, $W = \dfrac{1}{1 + \hat{\Lambda}_1 \times \hat{\alpha}}$.
$\hat{\Lambda}_1$ = the estimate for the average crash rate of all sites in the before period.
$\hat{\alpha}$ = the estimate of the dispersion parameter (from the negative binomial model).

Summary of FHWA Study Digital Sign Safety

28 January 2014

INTERNATIONAL SIGN ASSOCIATION

On 27 December 2013, the US Department of Transportation Federal Highway Administration (FHWA) released the results of a multiyear research study of driver visual behavior in the presence of digital billboards (CEVMS; "changeable electronic variable message signs" is the preferred FHWA term). This research had been long anticipated, but had been delayed for several years as the report's release has been contested. Updates from FHWA and USDOT staff at key conferences (TRB, NAHBA, AASHTO R-O-W) have mentioned discussions on the language in the cover memo and an objection raised in the peer review of the raw data.

In any event, the study (based on data collected in September 2009 -April 2010) has been released and the authors' conclusions are consistent with the favorable outcome expected by members of the on-premise sign and outdoor advertising industries.

Key Conclusions

"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."*** (emphasis added; pg i)

The study attempted to address three research questions:

(1) 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."* (emphasis added; pg 2)

(2) DO GLANCES TO CEVMS OCCUR THAT WOULD SUGGEST A DECREASE IN SAFETY?

"*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." (emphasis added; pg 2)

(3) DO DRIVERS LOOK AT CEVMS MORE THAN STANDARD BILLBOARDS?

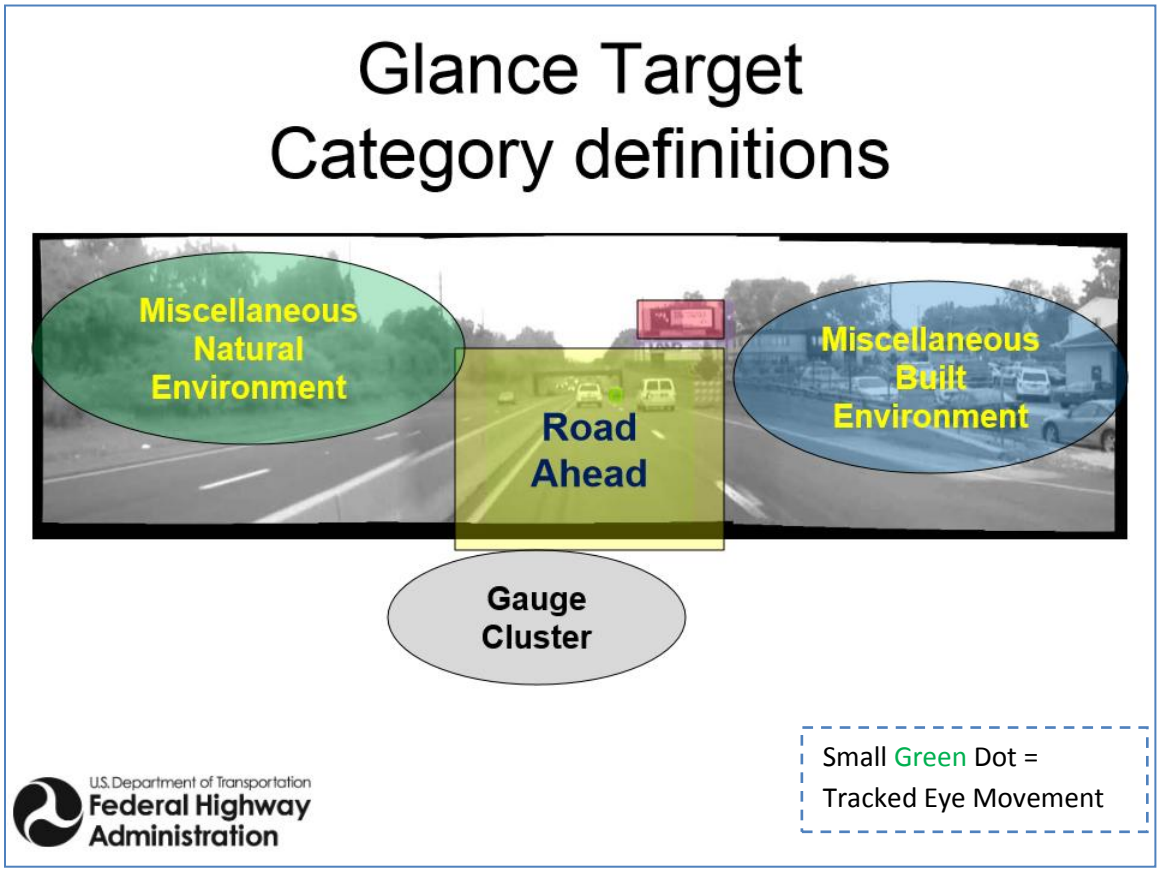
"When a gaze was to an off-premise advertising sign, the drivers were generally more likely to gaze at a CEVMS than at a standard billboard." (pg 3)

Overall:

> *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.* (pg. 4)

Details about the Study Itself

The need for further study of CEVMS was highlighted in a 2007 FHWA memorandum (that declared digital billboards operating with a message change rate of 4-10 seconds did not violate earlier prohibitions against "flashing"). In 2009, FHWA conducted a literature review (FHWA-HRT-09-018) to examine the overall body of research on the subject of safety effects of digital billboards. Following that literature review, this larger study began.



The researchers (employees of SAIC) conducted field studies in Reading, PA and Richmond, VA. Using a specially equipped test vehicle, drivers followed two specified routes (1 freeway; 1 arterial roads). Each route took 25-35 minutes to drive and was 13-20 miles long. In Reading, 43 drivers ages 18-64 (median age 46-47) were recruited to participate, though only 31 produced useable data (14 night; 17 day). In Richmond, 41 drivers ages 18-64 (median ages 25-28) were recruited to participate, though only 24 produced useable data (14 day; 10 night). The participants were not told the purpose of the drive; at the end, they were debriefed with questions about the presence of an in-car navigation system giving audible directions.

Key Numbers from the Study

- Drivers devote 73-85% of visual attention to the roadway
- Average "fixation" duration to digital billboards were 379ms (335 for standard), "similar to the average fixation duration to the road ahead"
- Longest fixation to a digital billboard was 1,335ms (1,284ms for standard), well below widely accepted threshold of 2,000ms resulting in higher crash risk.
- Four (of 55) individuals had billboard dwell (aggregate of consecutive fixations on same object) times in excess of 2,000ms, but three were to standard billboards, and all were positioned close to forward view (drivers still could see road in peripheral vision).

DRIVER VISUAL BEHAVIOR IN THE PRESENCE OF COMMERCIAL ELECTRONIC VARIABLE MESSAGE SIGNS (CEVMS)

SEPTEMBER 2012

U.S. Department of Transportation
Federal Highway Administration

FHWA-HEP-

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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15. Supplementary Notes The Contracting Officer's Technical Representatives (COTR) were Christopher Monk and Thomas Granda.		

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.

17. Key Words Driver visual behavior, visual environment, billboards, eye tracking system, commercial electronic variable message signs, CEVMS, visual complexity	18. Distribution Statement No restrictions.

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SI* (MODERN METRIC) CONVERSION FACTORS

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)		
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC
		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)		
^oC	Celsius	1.8C+32	Fahrenheit	^oF
		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 Theeuwees 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.

State	*Area*	*Limited Access*	*Arterial*	*Other* (1)	*Total*
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.

DCZ	*Advertising Type*	*Copy Dimensions (ft)*	*Side of Road*	*Setback from Road (ft)*	*Other Standard Billboards*	*Approach Length (ft)*	*Type of Roadway*
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:

> Vehicle Density = [(Number of Vehicles in Analysis Zone)/(Distance of Analysis Zone in ft/5280)]/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.

	Luminance (cd/m^2)		*Contrast*	
Day	*Mean*	*St. Dev.*	*Mean*	*St .Dev.*
CEVMS	2126	798.81	-0.10	0.54
Standard Billboard	2993	2787.22	-0.27	0.84
Night				
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.

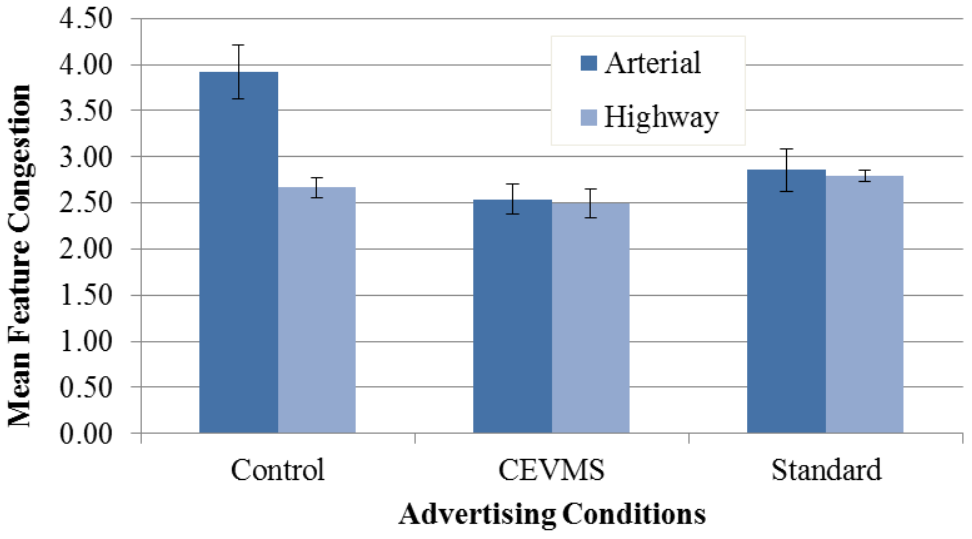

Figure 10. Mean feature congestion as a function of advertising condition and road type (standard errors for the mean are included in the graph).

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, χ^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.

Advertising Condition	*Arterial*	*Freeway*
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.

Road Type	***ROI***	***CEVMS***	***Standard Billboard***	***Control***
Arterial	*CEVMS*	0.07	N/A	N/A
	Left Side of Vehicle	0.06	0.06	0.02
	Road ahead	0.82	0.80	0.92
	Right Side of Vehicle	0.03	0.06	0.04
	Standard Billboard	N/A	0.03	N/A
	Participant Vehicle	0.03	0.05	0.02
Freeway	*CEVMS*	0.05	N/A	N/A
	Left Side of Vehicle	0.08	0.07	0.04
	Road ahead	0.73	0.77	0.86
	Right Side of Vehicle	0.09	0.02	0.05
	Standard Billboard	0.02*	0.09	N/A
	Participant Vehicle	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.

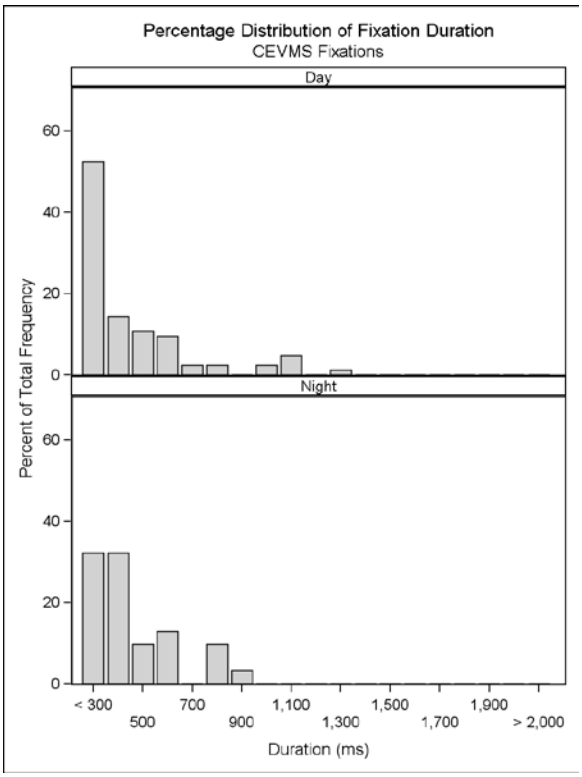

Figure 11. Distribution of fixation duration for CEVMS in the daytime and nighttime.

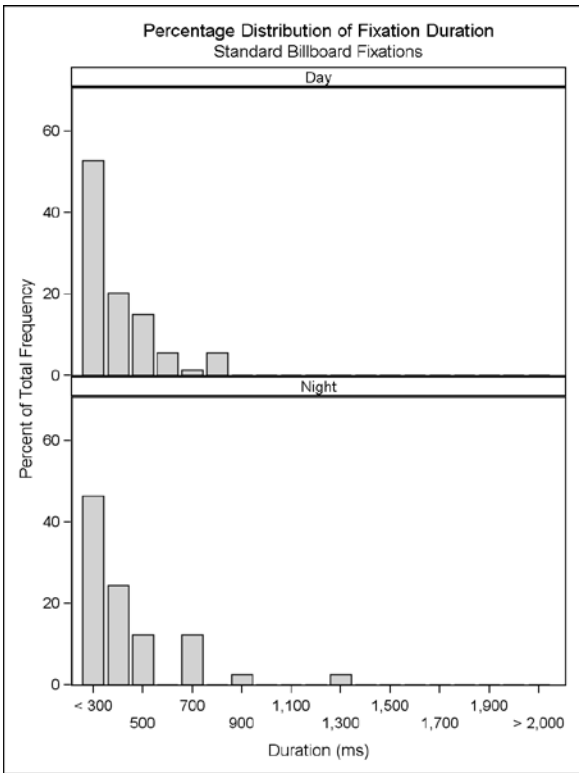

Figure 12. Distribution of fixation duration for standard billboards in the daytime and nighttime.

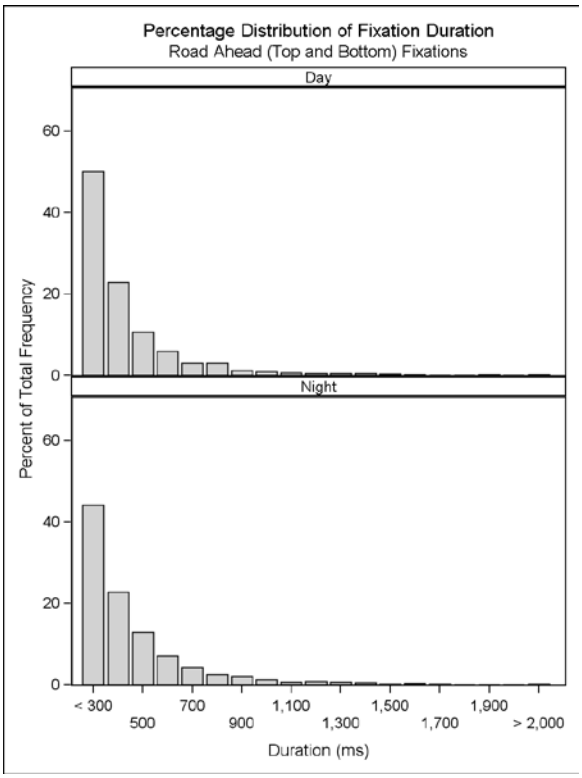

Figure 13. Distribution of fixation duration for road ahead (i.e., top and bottom road ahead ROIs) in the daytime and nighttime.

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.

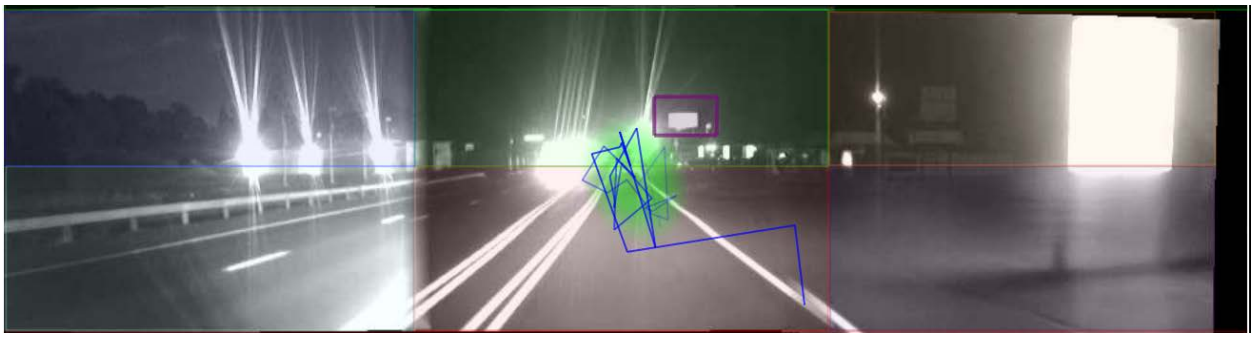

Figure 14. Heat map for the start of a DCZ for a standard billboard at night on an arterial.

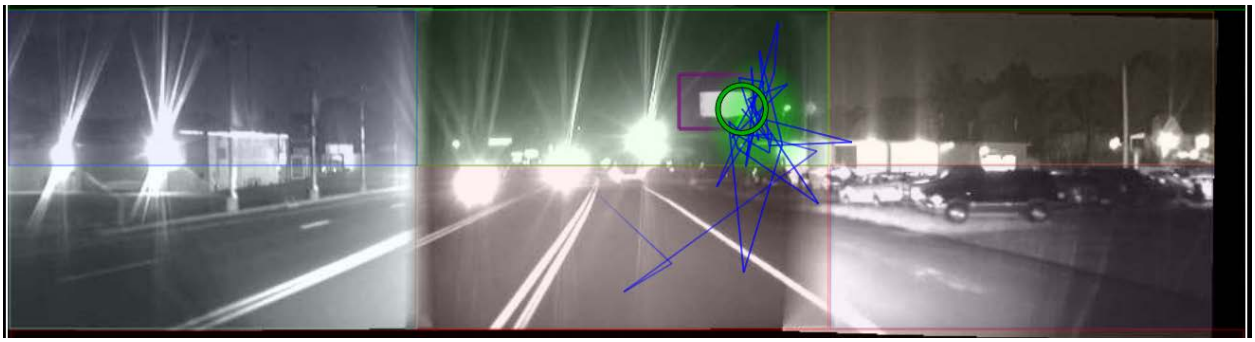

Figure 15. Heat map for the middle of a DCZ for a standard billboard at night on an arterial.

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.

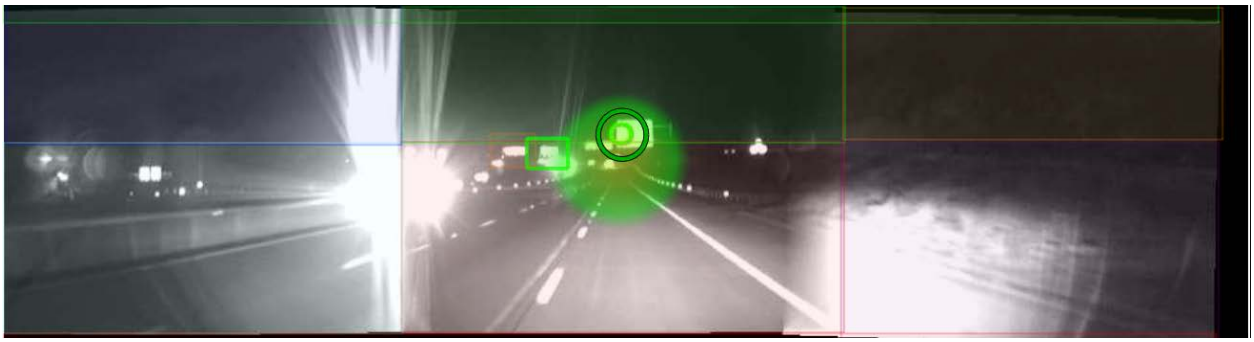

Figure 17. Heat map for start of a DCZ for a standard billboard at night on a freeway.

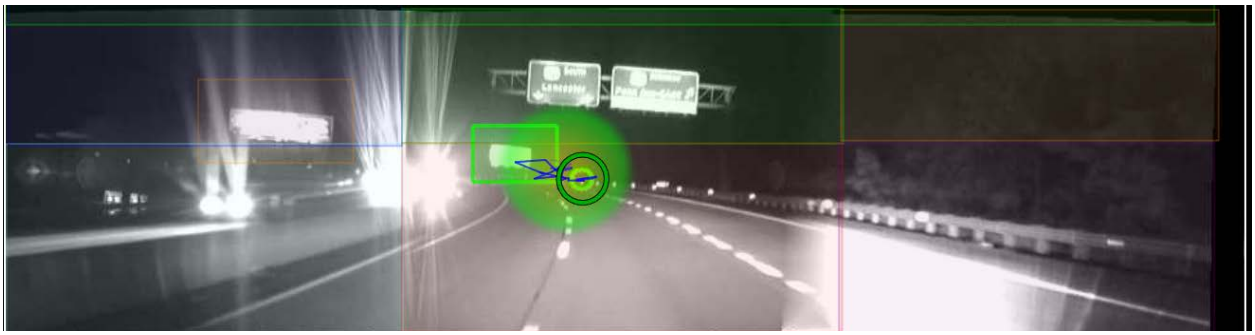

Figure 18. Heat map for middle of a DCZ for a standard billboard at night on a freeway.

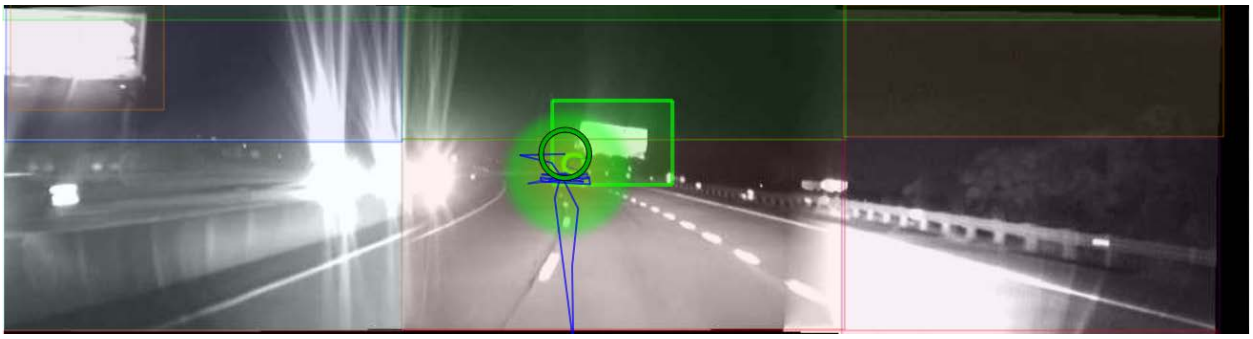

Figure 19. Heat map near the end of a DCZ for a standard billboard at night on a freeway.

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).

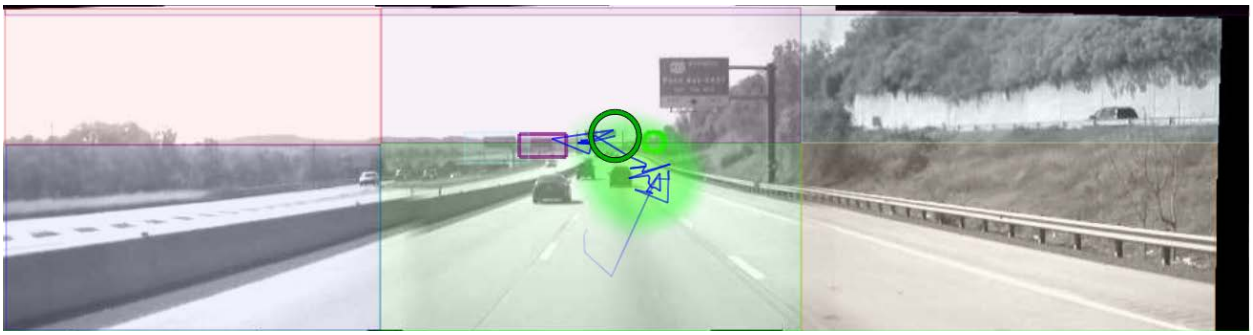

Figure 20. Heat map for the start of a DCZ for a standard billboard in the daytime on a freeway.

Figure 21. Heat map near the middle of a DCZ for a standard billboard in the daytime on a freeway.

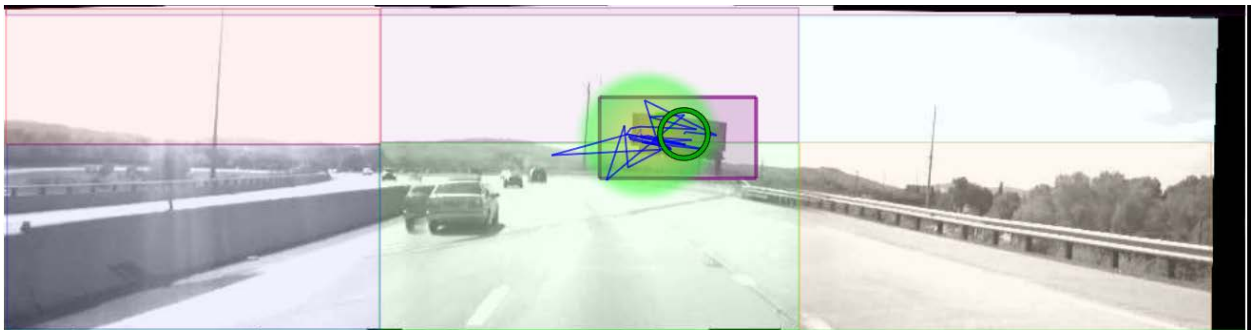

Figure 22. Heat map near the end of DCZ for standard billboard in the daytime on a freeway.

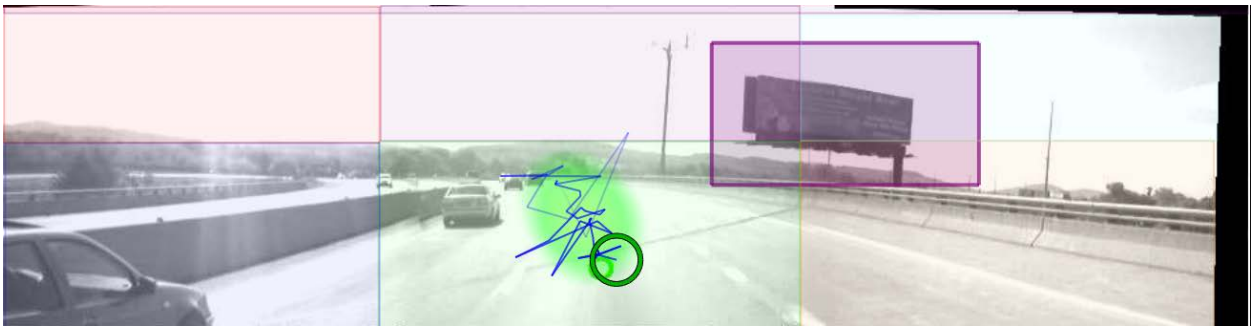

Figure 23. Heat map at the end of DCZ for standard billboard in the daytime on a freeway.

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.

	Arterial		*Freeway*	
	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 Salience 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.

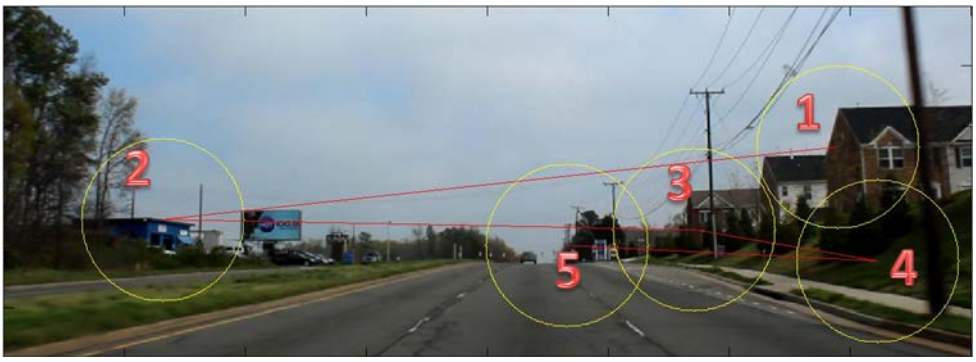

Figure 24. Example of identified salient areas in a road scene based on bottom-up analysis.

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, crowing 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.

DCZ	*Advertising Type*	*Copy Dimensions (ft)*	*Side of Road*	*Setback from Road (ft)*	*Other Standard Billboards*	*Approach Length (ft)*	*Roadway Type*
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.

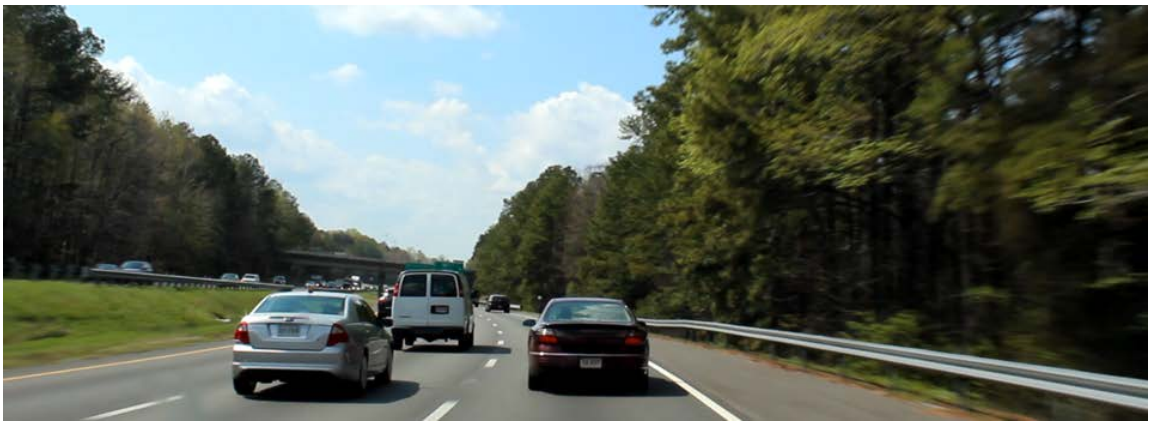

Figure 29. Example of a control DCZ on a freeway.

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.

	Luminance (cd/m^2)		***Contrast***	
Day	Mean	St. Dev.	Mean	St. Dev.
CEVMS	2134	798.70	-0.20	0.53
Standard Billboard	3063	2730.92	0.03	0.32
Night				
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.

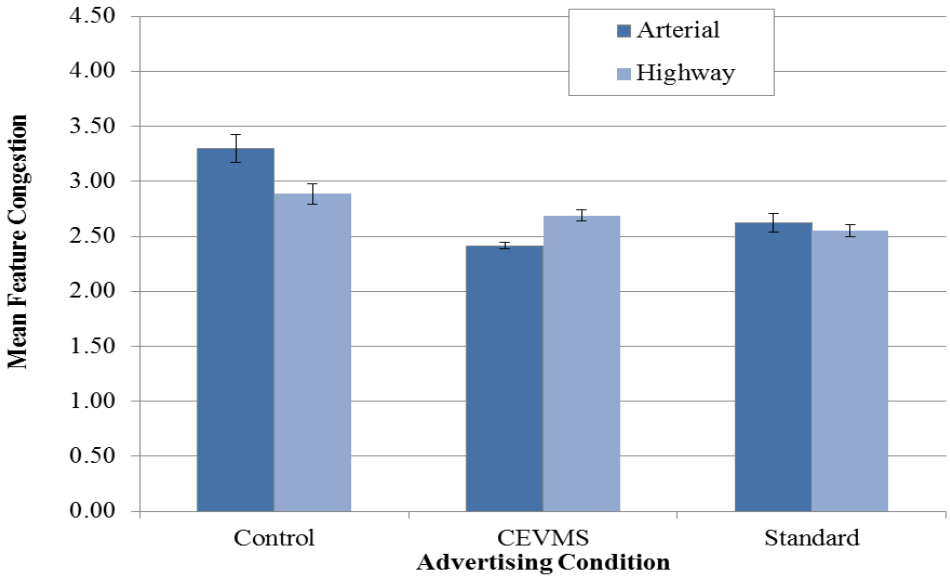

Figure 31. Mean feature congestion as a function of advertising condition and road type.

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.

Advertising Condition	*Arterial*	*Freeway*
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.

Road Type	*ROI*	*CEVMS*	*Standard Billboard*	*Control*
Arterial	*CEVMS*	0.06	N/A	N/A
	Left Side of Vehicle	0.03	0.05	0.04
	Road ahead	0.76	0.81	0.78
	Right Side of Vehicle	0.07	0.06	0.09
	Standard Billboard	N/A	0.02	N/A
	Participant Vehicle	0.07	0.06	0.09
Freeway	*CEVMS*	0.05	N/A	N/A
	Left Side of Vehicle	0.03	0.01	0.01
	Road ahead	0.82	0.85	0.92
	Right Side of Vehicle	0.04	0.04	0.03
	Standard Billboard	N/A	0.04	N/A
	Participant Vehicle	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.

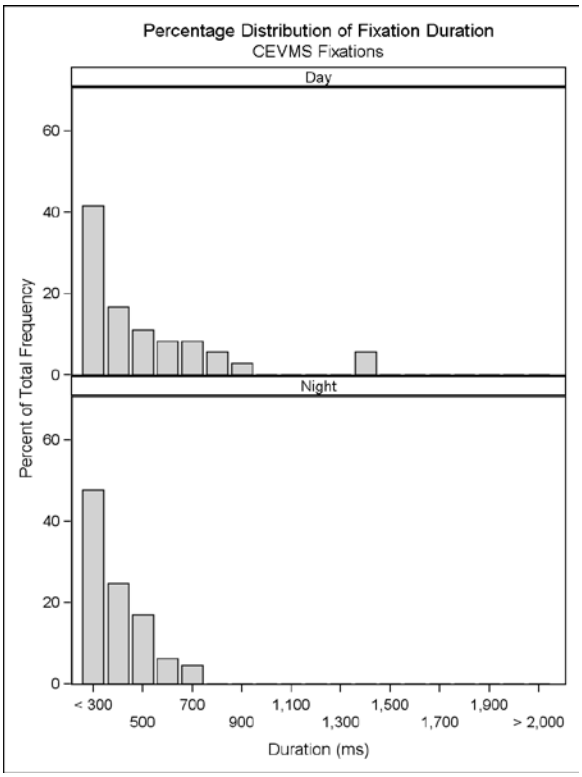

Figure 32. Fixation duration for CEVMS in the day and at night.

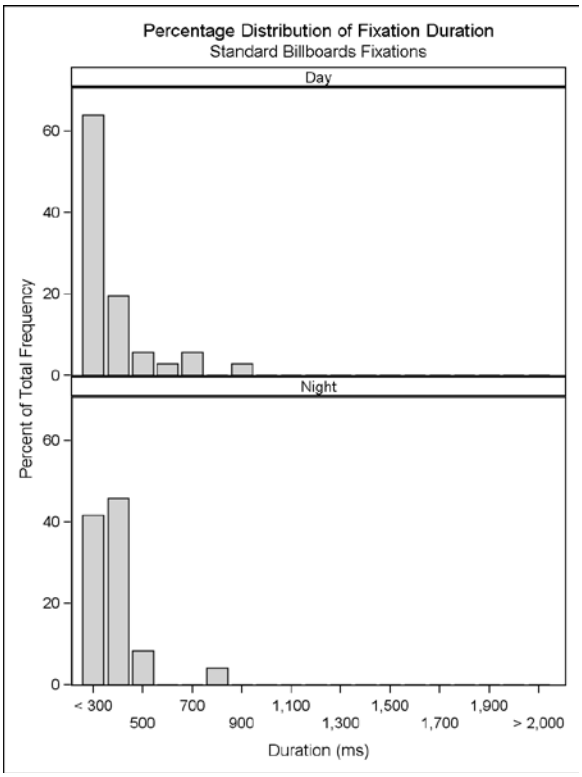

Figure 33. Fixation duration for standard billboards in the day and at night.

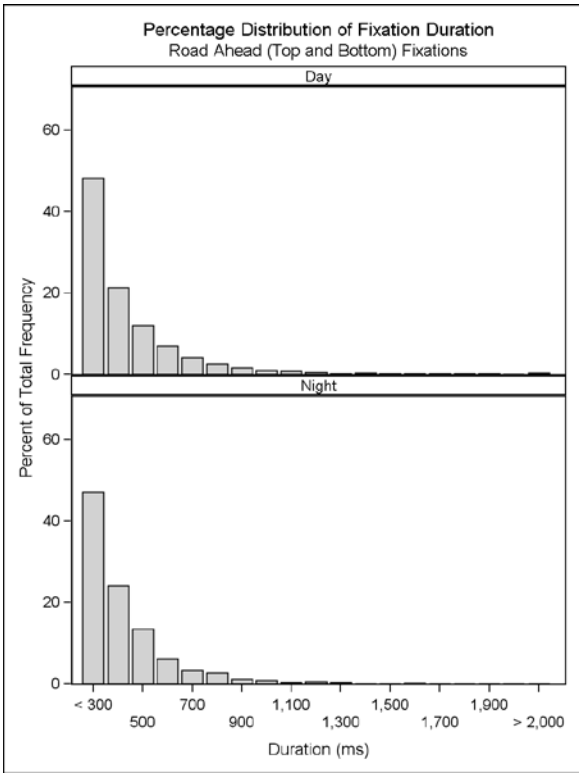

Figure 34. Fixation duration for the road ahead in the day and at night.

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.

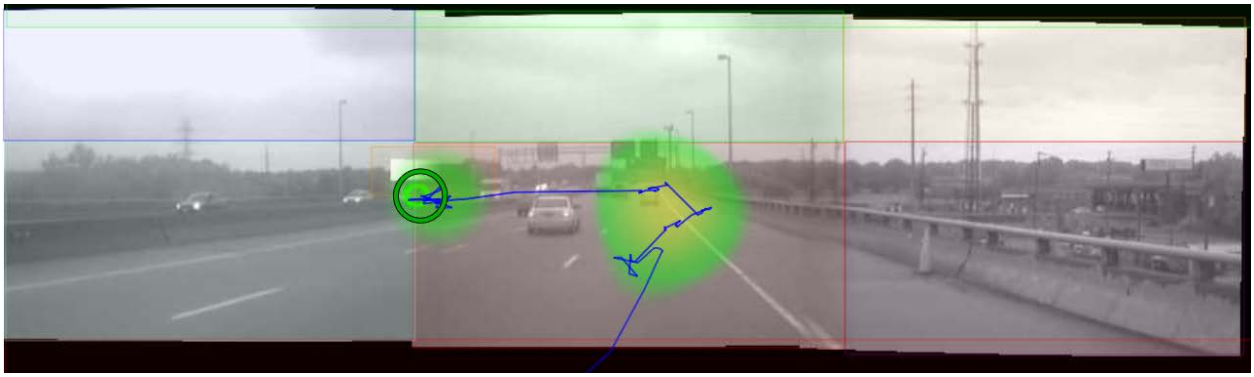

Figure 35. Heat map for first fixation to CEVMS with long dwell time.

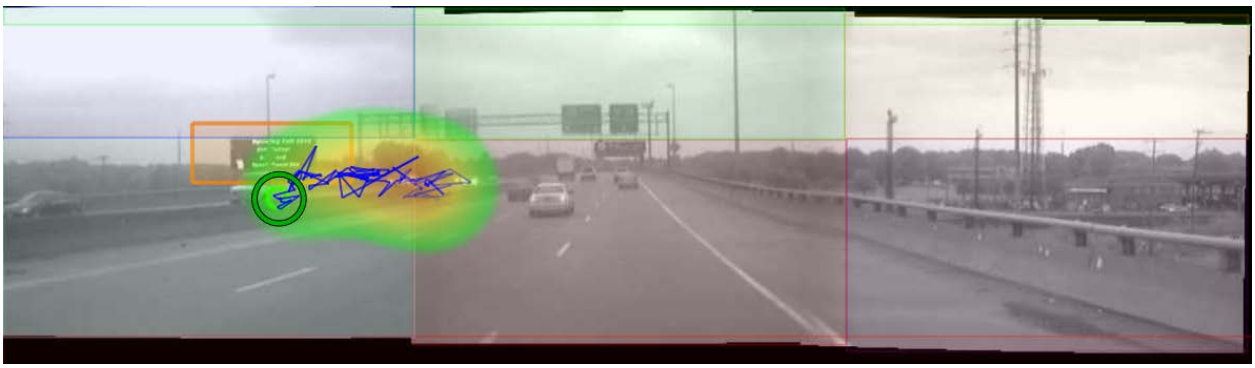

Figure 36. Heat map for later fixations to CEVMS with long dwell time.

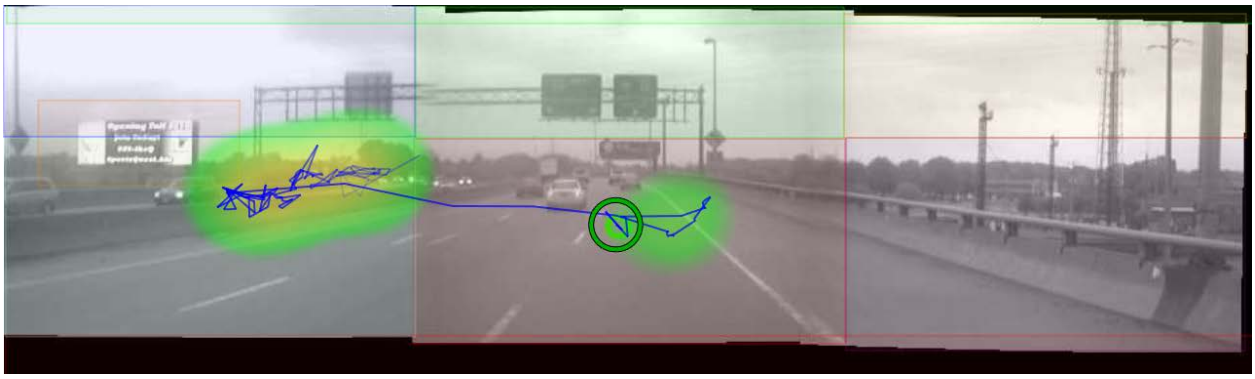

Figure 37. Heat map at end of fixations to CEVMS with long dwell time.

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, χ^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, χ^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 recognition[3] 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 about10,000 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 standards 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/m^2 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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The Economic Value of On-Premise Signage

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Executive Summary

Businesses of all sizes and types use on-premise signs to communicate with their customers. It has been suggested that on-premise signs and the regulations that limit them can significantly impact the performance of some types of businesses, yet there has been limited recent research to inform decisions about sign investment or regulation.

To provide more current insight, researchers at the University of Cincinnati conducted a national survey of businesses and a series of case studies. The purpose was to assess how changes in on-premise signage affect business performance. This report provides details about that research's approach and results. Business owners responding to the national survey reported that additional and improved signs are associated with increases in their revenues and profits. The case studies suggest that signage visibility and conspicuousness are especially important, and that signage plays an important role in a business' overall branding and marketing strategy. This research indicates that appropriately designed and located on-premise signage can be an important factor for retail business success. The implication of these results is that on-premise signage indirectly influences the vitality of a community and the quality of life of consumers by providing information about the availability of goods and services.

Examination of one field of economic theory – search theory – and application of this concept to the subject of signage presents a new explanation for why on-premise signs have positive economic impacts, not only for businesses, but also for consumers and communities: namely, signs make it easier for shoppers to obtain the information they need to make a purchase.

A national survey asked businesses about sign changes and the impact of those changes on business performance. In addition, detailed questions inquired about the nature of the business and the use of signs. The survey produced some significant findings regarding both economic impacts and sign preferences.

- Sign changes generally had significant, positive impacts on sales, number of transactions and profits. Roughly 60 percent of businesses reported increases averaging about 10 percent.

- Sign changes also led to small positive impacts on employment. Nearly a quarter of respondents reported hiring more people.
- While most single establishments and small firms have either wall signs or pole signs, most large companies have both. In general, larger companies tend to have more types of signs.
- Helping customers find their location was the most important purpose for respondents. Legibility is the most important characteristic of signs across all sizes of companies.
- Business logos and the size and location of the signs were more important for companies with more establishments, for whom branding is presumably more important, compared with single establishment companies.

Among the case studies, positive business performance was generally associated with greater use of on-premise signage and better quality signs, as the following results indicate.

- The national lodging chain case study found that the use of a digital electronic sign to display pricing was associated with increased average occupancy rates. The impact appeared to be especially strong for properties with lower occupancy rates.
- The national retail banking business case study found that pylon signs were strongly associated with high visibility, monument signs were moderately associated with high visibility, and wall signs contributed to identity but not visibility. In addition, pylon signs were associated with significantly more teller transactions.
- The specialty store small business case study demonstrated the need for signage to reaffirm the value offered by a niche retailer. Sign design must be sensitive to community and customer expectations, and able to reinforce the brand of a small business. The signage should communicate a "promise" of value for a product and/or service that is not commonly found elsewhere.
- The car dealership small business case study found that the addition of a video sign board was associated with increases in both service department revenue and customer traffic. An added benefit was the "goodwill" and reputational gain associated with using the video board for community-related public service messages.

Given the economic importance of signs, regulations should balance community design objectives with full knowledge of how sign design and location impact businesses success. Business success is important because of its impact on a community's tax base, and it ultimately leads to the availability of greater fiscal resources to provide needed community services.

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I. Introduction

Communication is perhaps the single most important activity for the success of human societies (Richmond & McCroskey, 2009). Signs are among the most important elements of visual communication. The visual communication provided by signs on our streets and highways is essential for an effective transportation system to aid in getting us where we want to go. Similarly, the visual communication provided by on-premise business signage is essential for the efficient function of our system of commerce and the success of many businesses. Effective signage can drive job creation, generate tax revenues, and provide quality access to goods and services.

Communities depend on clear, legible and conspicuous signs for direction, safety and information. Businesses have a long established history of using signs to announce their products and services. On-premise business signs are especially important within the context of our highly mobile society where we frequently venture to unfamiliar areas. On-premise signage allows a business to cost-effectively communicate with potential customers who are moving through its trade area. The wayfinding, identification and marketing information provided by on-premise signage is essential for assisting existing and potential customers in finding the goods and services they seek. This connection between customers and businesses is crucial for business success, and the local governments that depend on the employment and tax revenues which businesses generate.

On-premise signs are a potentially powerful medium for commercial communication. Frequently, on-premise signage is a key element, which is often used with other media, to develop and maintain a business brand. The more consistently that brand is communicated, the greater the likelihood that existing and potential customers will associate it with specific expectations for price, product brand, or service quality at specific locations.

On-premise signs that are designed well and properly located are especially important for generating impulse sales. While some goods and services are primarily purchased on the basis of careful consideration and forethought, many others are impulse purchases. Indeed, impulse sales generate an important part of revenue for a wide variety of retail businesses. One study (Conroy 2004) found 68 percent of purchases during major shopping trips were unplanned, and 54 percent on smaller shopping trips. In these cases, on-premise signage is critical.

This study provides current analysis of how on-premise signage is linked to business success. A California study from the 1990s indicated that changes to the number and location of on-premise signage can have a direct impact on business performance (Ellis, Johnson & Murphy, 1997). That study – which used statistical analysis of signage, business performance and location-specific data for two business chains – found that an increase in the number of on-premise signs at a particular site had a significant and positive impact on sales, number of customer transactions, and the amount of the average transaction. Case studies also have been used extensively in the small business and signage trade literature to document the impact of signage on the economic performance of businesses. For example, the New York State Small Business Development Center (Conroy 2004) details a number of case studies. One case, based on the experience of a car wash, documents the association of improved sign legibility and visibility with higher sales, as well as suggesting that the introduction of message boards can lead to increased sales. Another case, based on the experience of a small restaurant, documents the association of improved sign visibility and conspicuousness with increased sales. While these case studies do not provide conclusive evidence of the economic value of on-premise signage, they do provide insight to specific causal mechanisms that may be useful for interpreting the statistical analyses of the survey data.

For decades, alancing the signage needs of individual businesses with the broader concerns of communities has been a concern of local officials, the sign industry, and planning and design professionals. Funding for essential local government services such as police, fire, roads, and education often depend on the success of local businesses. This linkage between on-premise signage, business success, and local government revenues (and the public services they fund) highlights the need for sign regulation process to be informed by research such as is being conducted here. Signs regulations can and should promote designs that promote business success while meeting appropriate local standards.

The impact of on-premise signage is dependent on visual elements that may interact with and complement a business' marketing and branding strategies. Visual characteristics and perceptual concepts related to signs, symbols, semiotics, and the built environment have been addressed in Berger's *Seeing is Believing* (2007) and the two groundbreaking treatises by Tufte (*Envisioning Information* (1990) and *Visual Explanations* (1997)). An appreciation for the layering of economic and marketing roles together with a visual identity program becomes important for understanding the contribution of on-premise signage within a comprehensive marketing strategy.

The research presented in this report provides an analysis of the economic effects of signage within a context of varied scales and types of business. The objective of the study is to provide an updated assessment of the impact of signage on businesses and communities. Several earlier publications have identified key issues and economic factors associated with on-premise signage, with "The Economic Value of On-Premise Signage", "The Signage Sourcebook", and" What's Your Signage" providing reference and guidance for much of the past two decades. Except for the recent work of Taylor (2010; Taylor, Sarkees & Bang, 2012), the value of signage has lacked recent rigorous analysis.

This study uses survey data and case studies to bring the economic impact of on-premise signage into a clearer focus within prescribed theoretical frameworks and a diversity of sign applications. Venturi and Brown in "Learning from Las Vegas" (1971) analyzed the Las Vegas strip, its sign/buildings relationships, and their impact within our urban / suburban environment. Their study systematically assessed the visual impact of signs within a concentrated market area with ever-changing views from the automobile. Venturi was the first to connect on-premise signage to commercial symbols that contained economic value in their meanings beyond the direct communication objective and architectural product. Berger, Tufte, and others have provided additional understanding to advance the symbolic meanings contained in signage and signs. It is within such a broader framework that this research utilizes case studies in combination with economic data to bring the value of on-premise signage into a clear focus. Case studies are used for illustrating the diverse sign typologies and as an analytical interface with communities, brand identity, and the "marketing functions" of signs (Taylor, 2010).

II. Context

A. The Problem

The success of local retail businesses is important for creating jobs, generating tax revenues, and providing access to goods and services in communities both large and small (Blakely & Leigh, 2010). For most businesses, but especially those that sell retail goods and services, on-premise signs can be an important mechanism for attracting new customers and providing wayfinding for returning customers. This is especially true for businesses such as fast food restaurants, convenience stores, and gas stations for which impulse sales represent a substantial proportion of their total revenue (Conroy, 2004). Consequently, for a variety of economic and quality-of-life reasons, it is critical for the signage industry, businesses, and government agencies to maintain a current and nuanced understanding of how on-premise signs contribute to business performance.

B. Research Challenge

The primary research challenge has been to gather sufficient signage and business performance data to be able to reach conclusions about the effectiveness of on-premise signage. The need to collect both signage and performance data from a wide range of businesses, and draw from businesses' own experiences became clear from understanding the strengths and limitations of previous studies. A two-stage online survey model was designed and implemented with an initial survey, coupled with an opportunity for approaching self-identifying businesses to participate in follow-up, in-depth case studies.

Despite the relatively large number of survey respondents that we contacted, few businesses were willing to share detailed information about their signage and business performance. Assurances were given that proprietary information would be kept confidential and, where requested, names of businesses would not be used in any study disclosures. Ultimately, after persistent pursuit of leads from a variety of sources, three national/regional businesses agreed to share the necessary signage and performance data.

C. Previous Research

Research assessing the impact of signage on business performance must begin with an understanding of the fundamental purpose of on-premise signage: communicating with potential customers about where the business is located and the nature of its product or service. As such, signs may serve to establish or fortify a consistent business brand or image (Conroy, 2004). For some businesses, multi-media branding strategies may involve static on- and off-premise (billboard) signs, as well as television, radio, newspapers and flyers. Few small businesses can afford or justify such strategies, and rely on their on-premise signs for much of their marketing, particularly if communicating with potential customers is simply about identifying their product or service and location. New technology is expanding the sign choices available to businesses for communicating with potential customers. Electronic messaging and video displays on signs are becoming increasingly common, especially for businesses whose brand or image requires that they are perceived as cutting-edge in the quality of their products or services (Post & Pfaff, 2007).

On-premise signage is one of the most basic and yet complex forms of visual communication. Signage serves as a multi-purpose media that can identify an organization, business or place while at the same time marketing an idea, service, or product. There are a number of factors that should be considered in choosing a design and location for an on-premise sign because of the different communication purposes and audiences. For example, businesses seeking to capture impulse sales along a major highway will need different types of signage to be successful than those located in a pedestrian-oriented business district (Conroy, 2004).

Previous research has established the importance of well-designed and appropriately-placed signage for generating business revenue and associated tax dollars (Ellis et al., 1997). The exhaustive literature review and annotated bibliography by Christadoulou (2009) is the most comprehensive assessment of the recent signage research literature, containing 227 citations. Edelman (2009), in his presentation of Christadoulou's work, organized the literature into six areas: Business & Marketing, Graphic Design & Architecture, Engineering & Technology, Planning & Urban Design, Law and Psychology. Among these he found extensive overlap that made it difficult for researchers to organize the literature in a meaningful way.

Local governments recognize that sales, property, and income tax revenue are closely linked to the success of their businesses. In part to fortify arguments that signs are important for business success, seminal research was conducted to assess the impact of on-premise signage on the performance of a Southern California fast food restaurant chain and a national specialty import retailer (Ellis et al., 1997). The research used cross-sectional and time-series regression analyses to predict the impact of sign changes on site performance. For the fast food chain, a cross-sectional analysis estimated the effect of sign characteristics and control variables on sales revenue, number of transactions, and average amount per transaction. Among the variables included in the models, various signage improvements were the best predictors for all three outcome variables. For the specialty import retailer, multiple regression and time-series analysis estimated that sign specific changes or addition were associated with significant increases in sales revenues.

While the Southern California studies focused on fast food and specialty import chains, it has been argued that on-premise signage is likely to be even more important for small non-chain businesses (Conroy, 2004). Many small businesses do not have the relatively large marketing budgets and shared electronic media buys of national franchises. These small businesses are more likely to be dependent on their signage for most of their communication with potential customers.

Because the seminal investigation of the economic impact of signage used data from two chains, additional research is needed to determine if similar results extend to a broader range of retail businesses. Subsequent studies have contributed important and useful research in this area, yet none have estimated the economic value of on-premise signs across diverse business and local government contexts (Conroy, 2004). Consequently, important decisions about signage by businesses and local governments are frequently based on limited or no research because the results of existing studies are not adequately disseminated or are simply inapplicable. Indeed, local governments may impose stringent signage regulations based on vague aesthetic concerns, making it difficult for businesses to be creative and effective with their signage as a means of communicating with potential customers and without appreciating the potential economic and fiscal impacts of the restrictions. When a business depends on potential customers from outside of their community, effective signage becomes especially important. In such cases, signage location, visibility, and design are particularly critical. Equally critical is that local sign regulators recognize the need for creative approaches to signage for both business and community success (Blakely and Leigh, 2010).

The idea of communicating a coordinated visual message is important for business performance. A consistent approach to visual communication supports the branding of place by giving it a consistent identity. Businesses are working to sell their image, and local communities are doing the same but on a much larger scale. The ability of a business to successfully market itself is critical for the local economy. Branding serves to establish a base of customers, whether for a business or a community. When a sign is serving a community to its highest potential, such that it is visually appealing and noticed, it also seems to brand the business or organization that it represents. Eventually this image will be a familiar element for its viewers and they may want to know more about it (Heather, 2003). For both businesses and local governments, effectively designed and located signage is an essential part of a branding strategy (Heather, 2003).

D. Research Approach

Given the limitations of the earlier work, there is a clear need for an updated, rigorous study of the economic value of on-premise signage to guide both business and public policy decision-making. The purpose of this research is to address that need.

At the beginning of this project, the research team developed a conceptual framework for identifying possible relationships between on-premise signs and various economic impacts. The left side of this figure illustrates the complexity of on-premise signage. Research must consider more than just the size, number, and placement of signs; other signage and site characteristics can also play significant roles. On the right side, the listing of possible economic impacts suggests that signs may generate economic benefits not only for businesses but also for customers and communities.

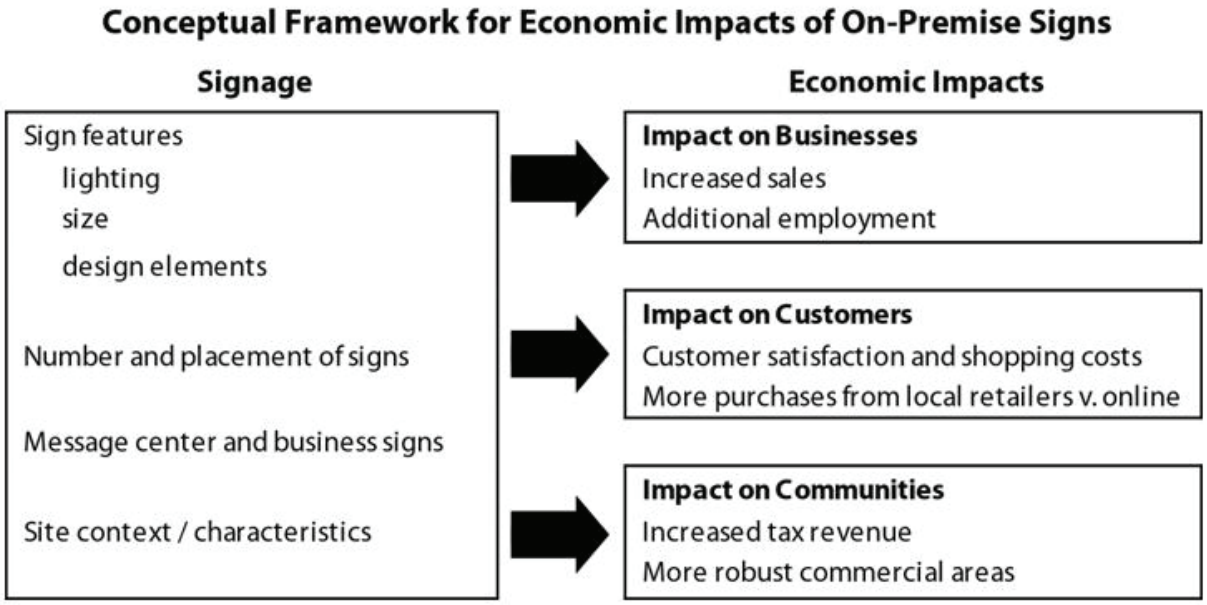

Figure 1: Conceptual Framework for Economic Impacts of On-Premise Signs

While no single research project can examine all of these elements and their interrelationships, this study attempts to move beyond the basic considerations that have characterized most previous research. Toward this end, a multi-faceted approach was selected, which includes applying elements of economic theory, developing and implementing a survey of sign users, and conducting case studies of a diverse set of businesses.

It is clear that on-premise signage is identified as a critical element for retail business and service industry providers for success, and it is also seen as indirectly influencing the vitality of the community. Therefore, this analysis takes a broad approach to considering the economic value of on-premise signage. This study is designed to appeal to a wide audience by attempting to use a common vocabulary to facilitate discussion of these findings among design professionals, regulatory professionals, and the sign industry.

III. Economic Theory and On-Premise Signs

Consideration of how signs benefit customers is an often overlooked, but a highly important dimension of the impact of on-premise signs. The recipients of the 2010 Nobel Prize in Economics were recognized for work in the area of search theory – a field that recognizes that information is not perfectly available, and obtaining it often requires time and other resources. Consequently, buyers often cannot purchase what or as much as they would like, nor can sellers meet these market demands efficiently. This research has implications for the sign industry because the principal purpose of on-premise signs – to provide information to potential buyers – is an area where this theory can be applied effectively.

The most fundamental sign message is typically about a) the existence of willing sellers and b) the types and prices of the items for sale, thus providing the most significant information that customers typically want. To the extent that signs effectively communicate the information sought by prospective customers, they reduce costs for consumers; conversely, when signs fail to communicate this information, they fail to reduce search costs of the consumers, businesses and communities. For businesses, a sign is often the primary way for the consumer to learn that the business even exists (Taylor, 2010). Significant economic research in this field continues today.

Customers' search costs include the value of the additional time spent searching for goods and services that match their wants. The consumer must make a decision—informed by any available signage—about the shopping potential of the store versus the option of continuing to search for other potential opportunities. For this section, we use this well-developed search theory to explain the process of a consumer evaluating prospective stores. This theory can help researchers better understand the effect of information on consumer behavior, such as the impact of a more visible sign on "downstream" businesses. The theory can also help researchers better understand how quality signage can lead to less total driving, increasing safety and reducing travel costs.

This figure provides an overview of the implications of applying search theory to the field of business signage. Just as good signage has a series of three consequences that produce positive economic impacts, impaired signage has a comparable series of three adverse consequences that produce negative economic impacts.

Impacts and Economic Theory: What Search Theory Tells Us	
Good Signage	Impaired Signage
1. Proper signage yields information to potential buyers, reduces transaction costs, improves well-being.	1. Inadequate information has costs for both sellers and buyers.
2. Better information allows buyers and sellers to find each other for a transaction.	2. Consumers are less well-off because of higher search costs.
3. Sign information moves markets toward an efficient outcome.	3. Internet sellers gain at the expense of other sellers and the communities where those sellers are located.

Figure 2: Impacts and Economic Theory: What Search Theory Tells Us

A. Origins of Search Theory

Most students of economics are taught the basic model in which consumers enter a market, a price is determined, and then a subset of these consumers will complete transactions with producers if that price jointly suits them. This outcome depends on a set of assumptions that lead us to a familiar conclusion: that a single price will be established, allowing potential buyers and sellers to choose whether they will take part in a transaction, and leading to determination of how much of the product will be sold. One of these simplifying assumptions – that information is freely available to everyone –does not reflect the realities of imperfect and costly information that business owners and consumers face on a daily basis. In reality, perfect information rarely exists, which often leads to many different prices for the same product.

Economists in the middle of the 20th Century sought to reconcile the theoretical prediction of the basic model with the variation in prices observed all around us. It became clear that adjustments to the basic model would be necessary to gain understanding of a world in which transactions for the same good were being completed at quite different prices, or in which inferior goods were bought and sold for the same price as superior ones.

B. Relevance of Search Theory to On-Premise Signage

Toward this goal, search theory, which examines how people make choices with limited information was pursued most famously by economists George Stigler and John McCall. In order to properly study information, its costly[1] nature had to be recognized. Search theory was originally applied to labor markets in the 1970s by Dale Mortenson and Christopher Pissarides. In 2010 the Royal Bank of Sweden chose to honor Professors Mortenson and Pissarides with a Nobel Memorial Prize in Economic Sciences[2]. In recent years, mainstream circles are recognizing the work that had already been scrutinized and affirmed by numerous scholars and graduate students for a generation.

In the work of Mortenson and Pissarides, search theory considers the employment decision of a job-seeker comparing an offer in hand against the "shadow of the future." The certainty of the offer on the table must be balanced against the prospect of continuing his job search into the future to seek potentially an even greater wage. Continuing the search is risky, and takes time. Because any other offer would begin at a later time, it would have to be at a more lucrative wage to match the value of the offer in hand; and there is always the possibility that future job offers might be at lower wages, not higher.

A well-known finding from search theory is that more uncertainty about the future causes a delay in the searcher's commitment. In other words, an offer in the present may be less attractive compared to a better offer that might occur if the search should continue. The job-seeker balances that potential upside gain by preparing to decline offers that are seen as unfavorable in comparison to anticipated future options.

Thus, in search theory, the searcher – whether a job seeker or a shopper – compares the value of the known alternative against the potential costs and benefits of continuing to search. It is clear that better information about these options makes it easier for searchers to form expectations about the unknown alternatives and whether or not to continue searching, assisting in producing a better match.
In order to connect search theory with signage, suppose that the person is a prospective buyer driving down the street in search of a gift for a friend. She encounters a series of stores that may or may not sell an acceptable item. If business signage is inadequate, learning about a price and other qualities of a potential purchase may involve a costly decision to enter a store, requiring expenditures of both time and travel. It is in this situation that information -- not just about pricing but also about the quality and nature of the goods on sale -- will be useful in sharpening the perception of the future that enables a purchase to take place. In such a situation, higher quality signage reduces these information costs, making buyers and sellers better off.

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[1] Economists use the term "scarce" to recognize something that is inherently limited in quantity, and therefore deserving of a price; information represents different tiers of cost, with some of it being readily available and easily processed, and some being only one of those or neither.

[2] Peter Diamond also shared in the Nobel Memorial Prize in Economics in 2010.

Signs provide signals to consumers. A store's sign may signal price, quality, convenience, and/or reliability. This signaling is illustrated by competing gas stations that post their prices immediately next to each other. Other information on their signs may help them to compete on other factors, all of which assist the purchaser by providing information that reduces consumer uncertainty. This sign information not only helps stores compete with each other but also with internet retailers, who generally have a large advantage over store retailers in providing information to consumers.

Search theory also provides insights about businesses that are trying to complete a transaction with a searcher. In the labor market application of search theory, making a job offer is costly to the employer because he must invest time, first in finding and screening job candidates and then in training a new employee. Because of these costs (and the risk of entrusting key business elements to a new employee whose competence is uncertain), the employer is highly motivated to find effective means in searching for prospective employees. This is comparable to the circumstances in which business owners compete for customers. Although stores and other businesses are searching for customers and clients rather than employees, many forms of advertising -- television, radio, celebrity endorsements -- represent costly signals because advertising space is scarce. Among these, outdoor signage ranks favorably in terms of effectiveness according to surveys of consumers (Kellaris, 2011).

James Kellaris, who holds the Gemini Chair of Signage and Visual Communications in the University of Cincinnati's Carl H. Lindner College of Business has illustrated how good signs reduce search costs by making information more available to consumers. Utilizing data collected in a 2011 survey of over 100,000 North American shoppers, Kellaris found that:

- Shoppers associate sign quality with store and product quality (34%); and
- Shoppers make store choices based on the information communicated by store signs (29%).

Potential customers often lack significant pieces of information. Even when businesses attempt to convey this information through their on-premise signage, characteristics of those signs and the surrounding environment, as well as other impediments, often inhibit the communication of this information. Kellaris also found that nearly half (49.7%) of American consumers have driven by a desired business without finding it because of insufficient signage.

There are significant anecdotal examples where the loss of good signage caused measurable decreases in the value of businesses. When one motel that had a highly visible sign moved to a less conspicuous location, it found that occupancy rates decreased 36 percent, which reduced its $960,000 value by 42 percent (Bass, 2010). Furthermore, the loss of a sign can have consequences that extend to surrounding businesses and the larger community. Real estate appraiser Richard Bass documented the case of a business on the back side of a Florida mall that lost the pylon sign that gave it visibility. The loss of customers eventually led to closing the store. Because surrounding mall businesses relied on the traffic generated by that store, they also closed.

Search theory has explained the role of information and how higher costs of obtaining information reduces the welfare of both the consumer and the producer. For job seekers, lower search costs allow them to be more selective, implying greater productivity shared between worker, firm, and (ultimately) the consumer. For consumers, improving information through better signage will decrease the time and resources needed to investigate another vendor. Reducing information costs effectively makes everyone better off.

By facilitating less costly sales, better information through signage can positively affect the broader community through economic growth (especially through increased employment and wages) and a stronger base for sales, income and property taxes. While others may focus on the intangible impacts on communities of quality signage, such as their contributions to a sense of place and identity, as well as building social capital and community pride, we emphasize that search theory explains the economic benefit of signage.

IV. National Survey

A. Survey Approach

To gain a broad perspective about a variety of on-premise signage considerations, a survey was prepared and distributed to all types of businesses in the US that use signs. The survey provided businesses the option of responding either online or by a mailed response. Questions were asked about sign changes and the impact of those changes on business performance. In addition, detailed questions inquired about the nature of the business and the use of signs (number, size, location, type).

Respondents were initially solicited by email, post cards and personal contacts. Also, newspaper and newsletter articles about the survey included information about the survey's Internet address and asked businesses to complete the survey online. An effort was made to gain responses from a geographically diverse cross section of the different types of large and small businesses that use signs to attract and retain customers. This approach was used in order to collect responses from a wide range of such businesses rather than to produce a random national sample. While the objective of employing this method was to collect data from respondents who have greater awareness of on-premise signage issues, responses did not indicate a response bias toward heavy signage users; in fact, one third of respondents reported no sign changes in recent years.

B. Survey Results

A total of 225 businesses responded to the nationwide survey of business sign users. Of these, 213 were usable responses. Of these respondents, 70 percent had a single establishment, while the remaining 30 percent were classified as either small (2-10 establishments) or large companies (more than 10 establishments). Single establishment businesses are more common among retail trade respondents (84%), and comprise about half of respondents in the accommodation and food service industry (52%).

The following table shows that, as large as these proportions are among survey respondents, single establishment businesses are even more common nationally, based on a census of U.S. businesses. However, these proportions are sufficiently comparable to be able to draw conclusions from the survey about general use of business signage.

Table 1: Single-Establishment Businesses as a Proportion of All

	Survey Respondents	2008 National Data[3]
All businesses	70%	90%
Retail trade	84%	90%
Accommodation and food services	52%	70%

In order to understand whether having multiple signs was important for their perceived impact on business performance, respondents were asked about the number of signs at a typical establishment. As shown in Table 2, over two-thirds of respondents had only one or two signs, a little more than a quarter had three to five signs, and only 4 percent reported 6 or more signs. Larger companies (10+ establishments) were far more likely to have more than 2 signs, with over half reporting 3 or more signs at a typical establishment.

Table 2: Number of Signs at a Typical Establishment by Size of Company

	All (n=213)	Single (n=150)	Small (n=35)	Large (n=28)
1-2 signs	69%	72%	71%	46%
3-5 signs	26%	23%	26%	43%
6+ signs	5%	5%	3%	11%

(Small companies have <10 establishments, Large companies have 10 or more establishments)

Left: Oakley Pub & Grill; Right: Buca di Beppo

[3] These national figures come from the 2008 Statistics of U.S. Businesses (SUSB). The SUSB is an annual series of national economic data by enterprise size and industry. SUSB covers most of the country's economic activity. The series excludes data on non-employer businesses, private households, railroads, agricultural production, and most government entities.

Questions about the types of signs were also included in the survey because this is frequently an issue addressed as part of sign regulations. As shown in Table 3, among the types of signs at a typical location, wall and pole signs were most common. While most single establishments and small firms have either wall signs or pole signs, most large companies have both. In general, larger companies tend to have more types of signs.

Table 3: Types of Signs at a Typical Establishment by Size of Company

	All (n=213)	Single (n=150)	Small (n=28)	Large (n=28)
Wall sign/s	60%	53%	54%	89%
Pole sign/s	53%	46%	49%	86%
Wall & pole signs	27%	19%	23%	75%
Monument sign/s	25%	15%	29%	71%
Other sign/s	30%	28%	31%	39%

(Small companies have <10 establishments, Large companies have 10 or more establishments)

Some of this variation in the amount of signage may be due to the different industry mix among large companies, but even when restaurants are the only category considered, large companies use more signs. This may be the result of a number of factors, such as differences in types of location and different customer markets.

As part of the survey, respondents were asked to rate on a 0 (zero) to 3 scale -- with 0 being not at all important and 3 being extremely important -- the relative importance of their signage for several common purposes of signs. Overall, the two sign purposes with the highest scores are: 1) making their business stand out; 2) helping potential customers find their location. These two purposes received generally high scores across all business size categories.

As shown in Table 4, the size of the company (and presumably access to multiple marketing modes to facilitate "branding") did make a difference. Companies with more establishments perceived 'brand reinforcement' as relatively more important compared to companies with a single establishment ($\gamma = 0.73$)[4]. This was reinforced when businesses were asked which purpose is the most important: 38 percent of large companies identified branding/image, compared to 14 percent of small firms and just 3 percent of single establishments. Other sign purposes showed measurable but weaker association with company size: compared to large companies, single establishments tended to give slightly more weight to using signs to inform about goods/services, and small companies generally use signs a bit more to inform about promotions ($\gamma = 0.16, 0.25$).

[4] A commonly-used statistical test for measuring the strength of association between two variables such as those used in this survey is Goodman and Kruskal's gamma (γ). Gamma measures the proportional reduction in error; it identifies how much the error in predicting variable "y" is reduced by taking variable "x" into account. In general, if $\gamma = 0.60$ or greater, the association is very strong, while a figure of 0.30 reflects a moderate association; if $\gamma = 0.20$, the association is weak.

Table 4: Mean Scores for Perceived Importance of Signs for Common Purposes, by Company Size (n = Number of Respondents)

	All (n=213)	Single (n=150)	Small (n=35)	Large (n=28)
Help customers find location	2.73	2.75	2.63	2.79
Make business stand out	2.68	2.67	2.68	2.75
Reinforce branding/image	2.42	2.30	2.57	2.86
Inform about goods/services	2.23	2.28	2.17	2.04
Inform about promotions	1.76	1.71	2.03	1.64

(0=Not at all important, 1=Slightly important, 2=Moderately important, 3=Extremely important)

When data on sign types and purposes are compared, those reporting that the sign purposes of "making their business stand out" and "reinforcing their branding/image" are extremely important were slightly more likely to have pole signs ($\gamma = 0.20, 0.31$). Some of the survey's findings about sign quality, number, and readability have been replicated in a more recent survey (FedEx Office, 2012), which found that:

- About three fourths of consumers have entered a store or referred a friend because of a sign that made the business stand out, and two thirds have made a purchase as a result.
- Conversely, most consumers indicate that bad or no signage deters them from entering a store.
- Sign readability is the most important sign factor in causing consumers to try a store's product or service.

Respondents also were asked to rate various signage characteristics in order to determine which specific characteristics were perceived to be most important. As shown in Table 5, among all companies, "being clearly readable" was the most important characteristic. This was true across all sizes of companies. However, again, the size of the companies did make a difference. Among companies with more establishments, and for whom branding is presumably more important, including their business logo was reported as more important compared with single establishment companies ($\gamma = 0.72$). Compared to other businesses, large companies also gave somewhat greater weight to "size / location" ($\gamma = 0.51$). Among small businesses, including single establishments, "conspicuousness" was the second most important characteristic, rated considerably higher than 'size and location' and "logo or branding" ($\gamma = 0.49, 0.31$).

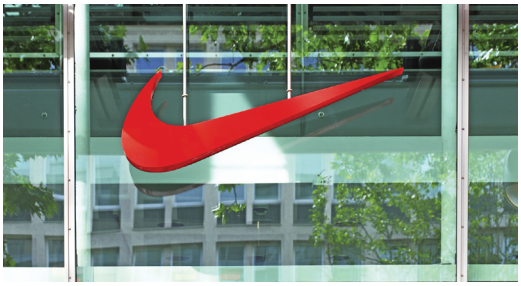


Table 5: Mean Scores for Perceived Importance of Sign Characteristics, by Company Size

	All (n=213)	Single (n=150)	Small (n=35)	Large (n=28)
Clearly readable	2.90	2.91	2.79	2.96
Conspicuousness	2.75	2.78	2.62	2.75
Size and location	2.64	2.65	2.43	2.86
Illumination	2.56	2.57	2.46	2.61
Logo or branding	2.43	2.30	2.60	2.86

(0=Not at all important, 1=Slightly important, 2=Moderately important, 3=Extremely important

Two of these sign elements were associated with signage types. Those businesses reporting that the sign elements of being 'clearly readable' and 'size/location' are "extremely important" were somewhat more likely to have pole signs (γ = 0.48, 0.44).

In order to assess how actual changes in signage might be related to the perception of the importance of signs, businesses were asked if they had made improvements in their signage over the past five years and their perceptions of the impact the sign changes had on four measures of business performance: (1) sales, (2) number of transactions, (3) profits and (4) staffing. About two thirds (66%) of all respondents reported one or more types of changes. Among the changes, as shown in Table 6, seven in ten of these companies reported making changes in their sign design. More than half (52%) improved sign visibility, while nearly half (47%) increased the number of signs, and three in ten made the signs larger. Because almost all changes consisted of more than one of these types of change, it was not possible to determine whether one change produces greater impacts than another.

Table 6: Types of Changes Made to Signs Over the Past 5 Years

Changed the design of signs	70%
Enhanced the visibility of signs	52%
Increased the number of signs	47%
Increased the size of signs	30%

Most of the companies reporting sign changes indicated that these sign changes had large, positive impacts across three of the four measures of business performance, with smaller but still positive impacts on the fourth measure. As shown in Table 7, between 59 percent and 65 percent of the companies making sign changes reported increases in profts, transactions and sales, with average increases of 9, 11, and 12 percent, respectively. These findings about the impact of enhancing on-premise signage are consistent with findings recently reported by Dr. Charles R. Taylor, John A. Murphy Professor of Marketing, and his colleagues at Villanova University (Taylor, Sarkees & Bang, 2012).

Increases in staffing were reported by a smaller proportion of the companies (23%), with an average increase of 6 percent. Employment growth may have been tempered by the national economic downturn rather than representing a different type of relationship with signage changes compared to sales, transactions and profits.

Table 7: Perceived Impact of Sign Changes on Business Performance

Performance Measure	% Reporting Increase	Average Increase
Sales	65%	12%
Transactions	62%	11%
Profits	59%	9%
Staffing	23%	6%

Additional analysis of the relationship between business performance and various signage factors revealed a number of sign characteristics that correlated with positive economic impacts.

- Businesses emphasizing 'conspicuousness' as a sign element were somewhat more likely to report larger increases in store sales ($\gamma = 0.45$), and those giving a high priority to size/location were slightly more likely to report larger increases in store sales ($\gamma = 0.28$).
- Businesses with pole signs were somewhat more likely to report larger sales gains ($\gamma = 0.42$).
- Those that experienced gains in sales, customers, and profits were much more likely to attribute those gains at least partially to their sign changes ($\gamma = 0.80, 0.74, 0.75$).

Some survey respondents included contact information with their surveys for additional follow-up. Researchers were able to reach roughly one third of those who provided this information (13 of 38), and they provided additional responses to questions during a brief interview. Most of these businesses surveyed were single establishments in free-standing structures or storefronts in a main business district . They were located on a site either having 45-50 mph speed limits and far from curb, or 25-30 mph and within 20ft of curb. Most interviewees indicated that 60 percent or more of their revenues were obtained from regular/repeat customers.

Most of these interviewed businesses added electronic message signs, and they indicated that their new signs had positive business impacts, but the results are skewed by what they characterized as poor general economic conditions. All affirmed that they had experienced an increase in business since they added new signs, but most were not very significant. Three or four contacts reported vast improvements (increases of over 40%) compared to business revenue prior to new signs. When questioned about use of their new signs, these businesses generally indicated that they had become more involved with sign "activities." They referenced very active updating information (a couple times a week), constant design change, and posting community "reputation boosting" information. Illumination at night was mentioned by customers as a great attention-getting advertisement while closed. When asked what they would do differently or what they would do for their next sign update, many said they wanted more electronic messaging capabilities, having already witnessed the impact on business performance. Some wished for a video board, feeling this would dramatically boost business, but couldn't be justified with current revenues and budget. These types of dialogues can serve as yet another foundation for future research.

This survey has generated numerous insights into how on-premise signage affects the business performance of retailers, hotels and eating places in order to inform important decisions about private signage investments as well as public discussions about signage restrictions. This research would have been much easier, and perhaps already completed, if the required data was available as part of public secondary datasets. Unfortunately, this is not the case, and this research has been required to rely on the cooperation of businesses to share proprietary data. Businesses agree to share data, usually on the condition that the results are shared with them, because they appreciate the need for this research for their own benefit as well as that of the communities where they operate.

Given that this survey captured self-reported information about individual businesses, questions may arise about its objectivity and validity. Fortunately, a body of marketing research has established that the self-reports of business owners about the factors that influence the performance of their business are highly correlated with those factors that could be identified using independent, objective data (see Robinson & Pearce, 1988; Venkatraman & Ramanuiam, 1986). Consequently, the results here can be reasonably considered to reflect the role of on-premise signage for a broad range of retail businesses.

V. Case Studies

Four case studies, drawn from a wide range of business sizes and types, offer detailed insights about the economic impacts that on-premise signage can have. Among the case studies, positive business performance was generally associated with greater use of on-premise signage and better quality signs.

A. National Lodging Chain – Value Place

Value Place is the largest economy extended-stay franchise in the country. Founded in 2002, it opened its 100th location in 2008, and its 175th in 2010. All properties have about 120 suites and are newly constructed.

According to the company's website, its properties combine hotel convenience and apartment essentials. Its business model is designed to appeal particularly to small and mid-sized business owners and families who are relocating to a new community.

The company has specific signage standards. The primary sign requirements consist of a wall sign with the company's logo on at least one side of the building, and a pole sign that displays its logo and pricing information.

The company also has several location criteria for its properties. The primary criteria are: interstate visibility, or at least a location along a primary arterial; a middle- to moderate-income area; and strong population density within a five-mile radius. These characteristics made it a useful case study.

Value Place Sign Configurations: Benefit of an Electronic Sign

Value Place has developed a number of pole sign configurations to help it communicate its message to potential customers. Its preferred arrangement utilizes an LED-lit changeable electronic sign. Changeable electronic signs are preferred because they can more effectively communicate multiple messages and because they are considered to be better at attracting attention.
In those locations where sign regulations prevent the use of such signs, Value Place uses signs with large plastic numerals, similar to those that gasoline stations post to advertise their prices. Approximately 73 percent of all properties have changeable electronic signs, while 26 percent use signs with plastic numerals, and the remaining one percent lack any pricing signage.

How does the type of signage affect the performance of various properties? For those with changeable electronic signs, 2010 occupancy averaged 11.2 percentage points above breakeven, while those with plastic signs averaged 9.5 points above this threshold. However, further analysis of this data shows that the advantage attributable to changeable electronic signs is predominately realized by properties in the bottom performance quartile.

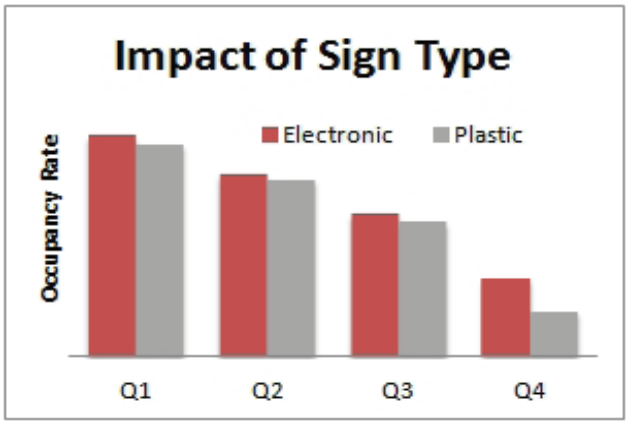


Figure 3: Impact of Sign Type

To perform this analysis, properties were first divided according to the type of sign they use to advertise their pricing. Next, each of these two groups was divided into four quartiles, based on their occupancy rates, and each group was compared with the other on a quartile-by-quartile basis.

As shown in the figure 3, in each quartile, electronic sign properties had a higher average occupancy rate than properties with plastic signs, but the difference was small, except in the lowest-performing quartile (Q4). This graph omits the scale for occupancy rate figure to protect the confidentiality of performance data provided by the company.

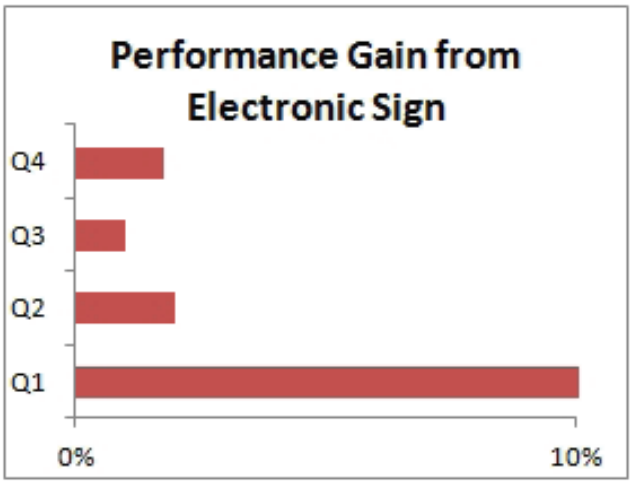


Figure 4: Performance Gain from Electronic Sign

Specifically, the performance gain from the use of electronic signs was in the range of one to two percent in the top three quartiles, but it jumps up to a ten percent advantage in the lowest quartile, as shown in figure 4. This suggests that those locations that are already performing well and have plastic signs are likely to experience limited benefit from the installation of an electronic sign. On the

other hand, such a sign change is likely to produce a substantial boost to the occupancy rates of properties that are currently struggling. This finding about economic benefits is consistent with other research on changeable electronic signs (van Bulck, 2011).

Signage with Price Information: Story of One Property

A second component of this case study involved a signage change at one property. At one Value Place location where local officials prohibited any pricing data on the property's sign, occupancy rates were so low that it was, at best, breaking even. After an extended period of discussions and negotiation, the company reached a compromise with local officials that provided for a multi-tenant sign that included space for Value Place, as the lead tenant in the development, to post its pricing. The new sign was erected in late October of 2010, nearly three years after the property opened.

For this analysis, information provided by the company consisted primarily of three years of monthly data on occupancy rates. Monthly data on posted and actual charged weekly rates were also provided in order to demonstrate that only negligible changes had occurred in prices.

The impact of the new sign has been significant. In the first nine months after its installation, the property has experienced an average occupancy rate that is 19 percentage points higher than the same nine-month period for the two preceding years. As a result, the property has now become consistently profitable, even in traditionally slower months. In addition, the property is now projected to generate an additional $30,000 a year in hotel tax revenues.

B. National Retail Banking Business

A bank with more than 500 branches nationally, which we will call Secure Savings, agreed to provide data about the use of signage as it pertains to Secure Savings' branch characteristics and performance. Secure Savings requested that its identity not be disclosed in the presentation of this case study.

The banking industry uses on-premise signage extensively and spends a great deal of money on branding, design, placement, purchase, and maintenance of its signs. Retail banking is a highly competitive industry, and branch visibility receives much attention and investment.

Some of the operating characteristics in retail banking are similar to those in the retail trade and accommodation/ food service industries. For example, in resource materials prepared for its members, the Bank Marketing Association advises: "Banks need to think more like retailers. Convenience retailers such as restaurants or gas stations know the value of good visibility. If your customers can't see your sign or find your building, they won't visit your branch" (Beery, 2002).

Signage concerns begin at the site selection stage. Selection criteria for Secure National Bank include visibility and convenience of access, along with population density and size. "We need to be visible so that, when people need us, in their minds, they know where we are," stated one of the bank's real estate executives.

Case Study Approach and Data

Secure Savings has extensive data on its branches, which permit a more extensive analysis that explores issues beyond the basic signage considerations that have dominated previous research. As with the previous case study, this analysis focused on 47 locations within a single metropolitan area, which serves to eliminate many non-signage factors that would otherwise be difficult or impossible to control for.

The dataset for this analysis includes details about:

- Standard sign factors: number, type, size, height, design;
- Unique data on visibility and placement;
- Assessments of market factors for each branch location; and
- Business performance metrics.

Two types of analysis are described here. The first examines the relationship between the sign packages for individual branches and an independently-conducted evaluation of branch visibility. The second analysis examines the impact of both of these dimensions on branch performance.

Comparing Signage to Banking Center Visibility

Using the data on these individual banking locations, it is possible to examine the relationship between the visibility score assigned to the banks and their on-premise signage characteristics. These scores were part of a broader six-factor assessment of banking center conditions that was performed by an outside consultant. To illustrate how scores were assigned to banking centers on these characteristics, the description of the visibility categories is presented. For more detail on the remaining categories please see the technical appendix.

The other five characteristics on which bank branches received a score from one to five (with 5 being the best score) were: location, accessibility, and parking for the banking center; and land use pattern (land use mix and density, traffic flow) and life cycle (age and economic vitality) of the surrounding area.

Table 8. Banking Center Visibility Score Categories

5	4	3	2	1
Location is immediately visible from a great deal of distance and is easily found.	Location is immediately visible and can be seen in the traffic patterns with little difficulty.	Is visible but no more or less than surrounding competitors or retailers.	Is partially visible from the surrounding roadway although obscured by impediment like landscaping or other building.	Building is easily missed when driving by and is likely wholly or partially obscured.

Table 12 contains information on the proportion of banking centers in each score category for the factors mentioned above. The great majority of banking centers (nearly 80%) received a visibility score of 4 or better. On the other three banking center characteristics – their location, accessibility and parking – the banking centers showed greater variation. The surrounding areas tended to receive average to strong scores for land use patterns, indicating they generally would be expected to give reasonable support to the bank branches, while life cycle showed greater variation.

Table 9. Banking Center Condition Scores

Score	Banking Center Characteristics				Surrounding Area Characteristics	
	Visibility	Location	Accessibility	Parking	Land Use Pattern	Life Cycle
5	36.2%	23.4%	17.0%	4.3%	40.4%	14.9%
4	48.9%	46.8%	38.3%	34.0%	25.5%	14.9%
3	12.8%	25.5%	40.4%	46.8%	27.7%	44.7%
2	2.1%	4.3%	4.3%	10.6%	6.4%	25.5%
1	0.0%	0.0%	0.0%	4.3%	0.0%	0.0%

The primary question is the extent to which sign characteristics of the banking centers are related to the independently assigned visibility score. The table below contains summary statistics on the sign characteristics of the banking centers, grouped according to the visibility score. Generally speaking, banking centers with higher visibility scores also tend to have more signage. In particular, pylon (or pole) and wall letter signs are more prevalent among locations with the highest visibility score. Across the 17 locations with a visibility rating of 5, there are 0.94 pylon signs, on average. These locations also have substantially more square footage of signage, 226 square feet on average, than lower scoring locations.

Table 10. Banking Center Sign Characteristics by Visibility Score

Visibility Score	Number of Banking Centers	Average Number of Signs				Average Square Feet
		Pylon	Monument	Wall Letters (Vertical)	Wall Letters (Other)	
5	17	0.94	0.29	0.71	1.29	226
4	23	0.30	0.52	0.61	1.17	165
3	6	0.17	0.50	0.67	1.17	108
2	1	0.00	1.00	1.00	1.00	105

The amount and type of signage are not the only factors that contribute to a banking center's visibility score; the characteristics of the physical location and surrounding area also play a role. To examine this relationship, the Economics Center analyzed a statistical model predicting the probability that a banking center would have the highest visibility rating. The model calculated the probability that a banking center location received a visibility level of 5 as a result of the following:

- the number of signs by type (pylon, monument, wall letters);

- the total square footage of signage;
- other banking center characteristic scores (location, accessibility, parking);
- surrounding area characteristic scores (land use pattern, life cycle).

The modeling technique allows for estimating the impact that each included variable contributes to the outcome of interest. Thus, by taking into account what is known about the banking centers and the surrounding areas (condition scores), the model permits an assessment of the added value of the included sign characteristics on the visibility score. The table below contains the results.[5]

Table 11. Probability of Having the Highest Visibility Score

Explanatory Variable	Impact on Probability	Statistically Different From Zero
Number of Signs, by Type		
Pylon	0.91	Yes
Monument	0.38	Yes
Wall Letters Vertical	0.08	No
Wall Letters Other	0.12	No
Total Square Footage of Signage	-0.003	Yes
Banking Center Characteristics		
Location	0.43	Yes
Accessibility	0.08	No
Parking	-0.08	No
Surrounding Area Characteristics		
Land Use Pattern	-0.06	No
Life Cycle	0.12	No

[5] See the technical appendix for a table containing the full regression results.

Factors That Affect Bank Visibility

The statistical analysis indicates that three factors have effects of much greater magnitude than the others. These three –location, pylon signs, and monument signs – are illustrated in the figures 5 and 6.

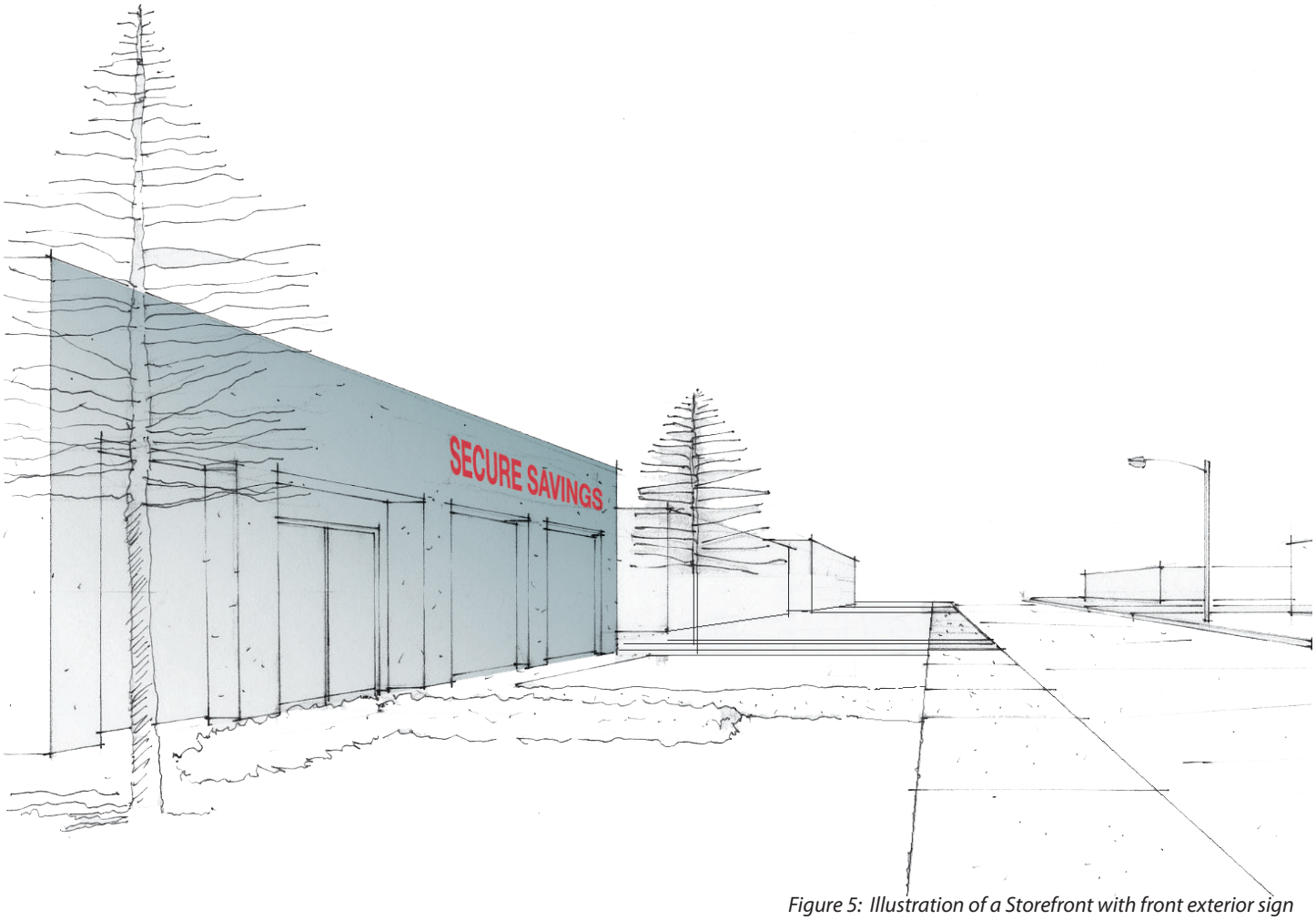


Figure 5: Illustration of a Storefront with front exterior sign

Having the prime location in the market results in a 43% greater likelihood of receiving the highest visibility score, compared to just a good and visible location.

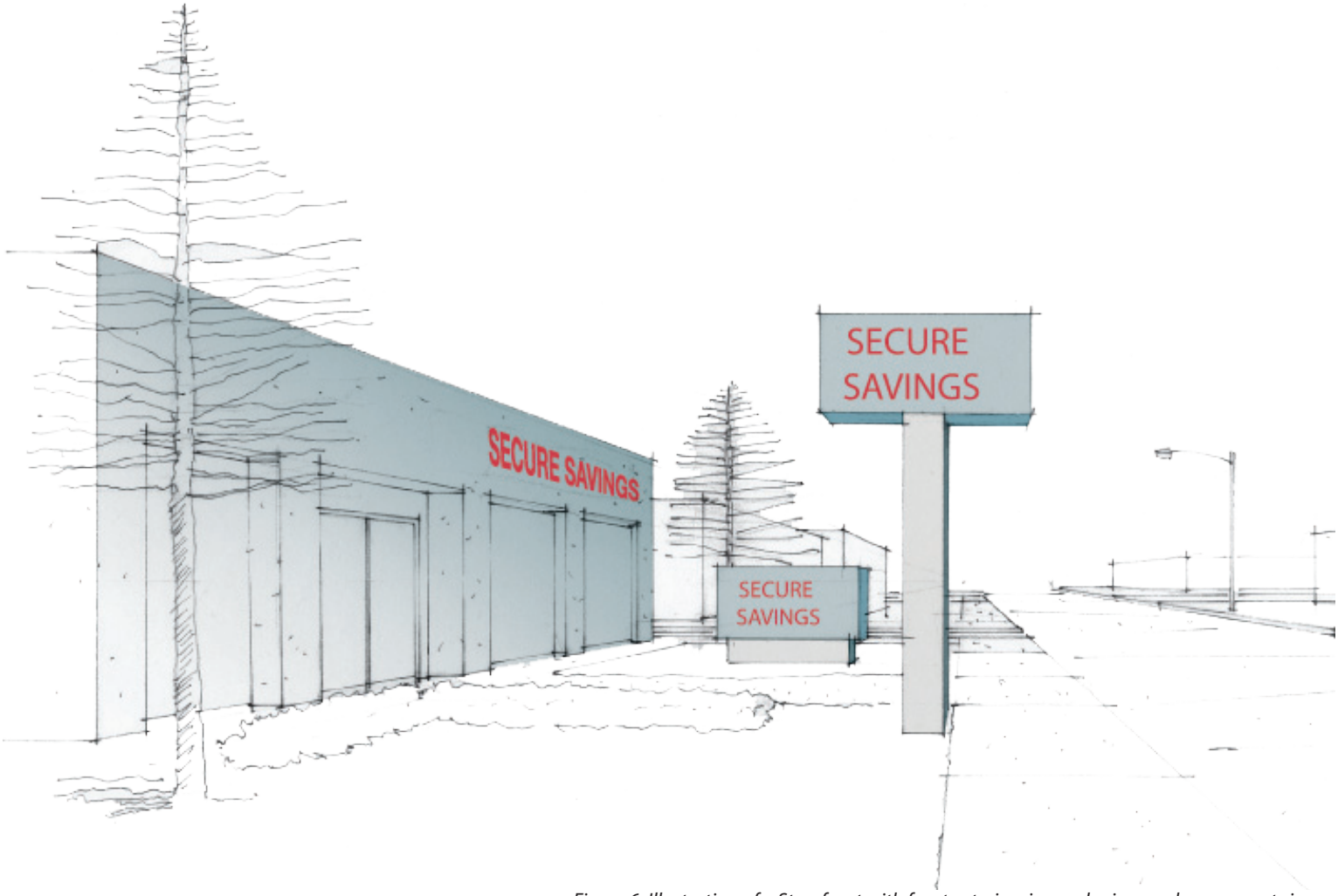


Figure 6: Illustration of a Storefront with front exterior sign, pole sign, and monument sign

The monument sign increases the probability of a maximum visibility score by 38%; the pylon sign increases the probability by 91%.

As shown above, certain on-premise signage has the greatest impact on bank visibility. The presence of pylon and monument signs increases the probability that a banking center has the highest visibility rating, even after taking into account other characteristics of the banking center and surrounding area. Specifically, each pylon sign is estimated to nearly double the probability (91% increase) of a visibility rating of 5, while a monument sign increases the probability by a little more than one-third (38%). According to one bank executive, "Pylon is the first choice because it can be seen from farther away." Acknowledging that mature trees occasionally block views of the signs, he observed that a pylon sign stands out more, which helps customers locate and drive to the bank more easily and safely.

Among the factors included in the model, the only other one that appears to have a significantly positive impact on visibility is one of the banking center characteristics – location – which produces a 43 percent increase in the probability of a top visibility score. The total square footage of signage is estimated to have a weak, negative

relationship to the probability of having the highest visibility rating. Each additional square foot of signage on premise is associated with a decrease of 0.3 percent in the likelihood of the location having the highest visibility rating. This result may occur because banking centers in poorer quality locations are compensating with more signage.

Comparing Signage to Banking Center Performance

The second part of the analysis examines the impact of signage and other condition characteristics on branch performance. The sample consisted of the same 47 banking locations previously analyzed. The outcome of interest was average monthly teller transactions in 2011. This component of the analysis modeled the incremental impacts of on-premise signage and condition characteristics on the number of average monthly teller transactions. The model analyzed teller transactions as a function of:

- the number of signs by type (pylon, monument, wall letters);
- other banking center condition scores (location, accessibility, parking); and
- surrounding area condition scores (land use characteristics, life cycle).

Table 16 contains the results of the model.[6] The results indicate that, when taking into account the other variables, a pylon sign is associated with 1.15 times the average monthly number of teller transactions. The statistical significance of this result is relatively weak, but the magnitude is roughly the difference between a bank having 375 daily teller transactions and 325 transactions. This difference is a considerable impact on monthly transactions, and no other signage characteristics exert a statistically significant impact on the outcome of interest.

Not surprisingly, the rating given to banking center parking is the only other variable that has an impact on teller transactions. As these transactions occur on-site, it is reasonable that banking centers with more available and more easily accessed parking would also tend to have more transactions.

[6] See the technical appendix for a table containing the full regression results.

Table 12. Average Monthly Number of Teller Transactions		
Explanatory Variable	Impact on Monthly Transactions	Statistically Different From Zero
Number of Signs		
Pylon	1.15	Yes
Monument	1.03	No
Wall Letters Vertical	1.09	No
Wall Letters Other	1.00	No
Banking Center Conditions		
Location	0.93	No
Access	1.09	No
Parking	1.15	Yes
Surrounding Area Conditions		
Land Use Characteristics	1.08	No
Life Cycle	1.03	No

C. Specialty Retail Small Business – Bob Roncker's Running Spot

This case study addresses a small business retail establishment in its expansion from one store to four stores in a major Midwestern city. The study examines a local specialty store chain of four small stores specializing in running and walking shoes, accessories, and apparel. These niche specialty retail stores provide an ideal case study for the effectiveness of signage and branding. The four retail outlets have a single owner. The original store has been in business for 30 years, adding three stores over the past several years. A program to refresh store signage in the context of an expanded branding strategy has paralleled the company's bricks-and- mortar growth.

The first Bob Roncker's was established in 1981, offering industry-specific advice and high quality running/walking products. This first store was located in an older streetcar suburb business strip on a busy commuter artery that leads to both the downtown and a major university within the region. The regional trade area has about 1.2 million residents. Early in 2008, a second store was added in a similar, well-established commuter suburb near the outer interstate beltway, a substantial distance from the city core..Later in that year, a third store was opened in an historic suburb located alongside a popular bike / running path. A fourth store opened in 2009 near

a successful riverfront commercial development. All four stores are devoted to retail sales of quality specialty running / walking lifestyle products.

This small specialty retail store case study offers insight into the role of on-premise signs at several levels: as an element of communication within the context of a specific streetscape; as an element of a comprehensive branding strategy within a niche market; and as reaffirming the stores' commitment to quality goods and services. This study also demonstrates how a small retailer can use signage to target a specific, narrow market within an upscale residential community with strict sign regulations. The small retailer has fewer options for communicating with its existing and potential customers. This requires that signage and branding strategies be an integrated package that is consistently applied.

Each of the four stores' building configurations, architectural styles and signage regulations present unique challenges for on-premise signage. Each requires site-specific signage design while maintaining consistency in graphic communication. Graphic composition and sign 'appropriateness' need to be balanced while maintaining conspicuity and legibility.

Store One: The original store location

This two-story brick structure sits close to a major busy street in a small suburban commercial district outside the urban core of a major river city. The modest face-mounted sign has a distinctive logo and san serif calligraphic style typeface. The clarity of the sign itself is due to the careful composition of elements – logo and graphically-stylized business name. The clean design and signature-styled font letters reflect the owner's desire for straightforward business dealings, personal service, and quality products. The well-designed painted sign is constructed and composed to reflect the commitment to customer satisfaction and product quality rather than conspicuity and over -powering visibility. Modesty and visual restraint set the theme for all of the four store signs, allowing consumers to focus on quality and service of their brand over expediency and budget.

Store One has four on-premise signs: a face-mounted building sign on the second floor façade, a small face-mounted door sign providing store hour information, a very small bayonet mounted sign, and a sandwich curb sign for special events and sale announcements. Because of the 10-foot sidewalk set back distance of the building and the parallel curb parking, the two small face-mounted signs are only readable from directly across the street. It is a direct

view perpendicular to the building's brick façade. This doesn't allow visual access to the sign from moving traffic in either direction. A moveable sidewalk sandwich sign provides an opportunity to announce specials, but the curb parking and small sidewalk trees obscure any chance for good readability to the fast moving traffic. The bayonet sign is so small (approximately 9" x 20") and placed under the awning as to obscure the communication value to all but pedestrians within 10 to 20 feet of the store entry.

The store has updated its awning and added a distinctive brand graphic logo and descriptive stylized text that is located on the front of the awning's sloped surface and fascia. The new awning design strategically plays off the color palette of the city's dominant university to reinforce the store's local commitment to its customer base. The awning is the best choice for added signage because regulatory codes allow only limited signage development and is restrictive to face-mount signs. The new awing signage has added a distinctive branding presence to the façade and a new communication identity that the building's other signs are unable to provide. This signage addition also adds a 'freshness' to the façade and provides a point of location for the fast moving traffic. Personal interviews with customers noted that the new signage graphics have helped identify the store from the street and have contributed to their interest in visiting.

Store Two: Expansion store 1999

The first addition to the store chain occurred in 1999. Following the precedent of the original store, modest signs are placed more for communication with pedestrian and slow moving traffic. This attitude and restraint is a response to the context of the small historic commercial district located within a quaint suburban neighborhood. A tenuous free-standing sign and a small, stylized, bayonet sign identify the store entry. Because of the building's setbacks, curb parking, and adjacent buildings, the store window displays and entry are hidden from street traffic. A sandwich sign is also used to announce sales and events. The low-key signage attitude fits with the community's desire for residential scale and historic references to maintain the upscale historic suburban lifestyle. Signage here is only a reminder for the entry and is not intended to take on much of a leadership role in expanding the consumer base. Other branding means are utilized. Signage is down-played with the bayonet-style sign, adding to the traditional small town atmosphere.

Store Three: Expansion store 2009

The established logo and stylized type of the original store helps the on-premise signs take a more prominent role at the third location. Located in a refurbished suburban train station, the signage must reach out to the community to pinpoint the store's location and attract new customers. The abandoned railroad tracks are now a popular biking and running / walking route that generates many retail opportunities. This location allows and requires the signs to pull away from the building and be located for vehicular traffic, bicyclists, runners and walkers. A prominent sign gives motorists good viewing from adequate distances, and a temporary sandwich sign adds to the attractiveness of a quaint business. The ambiance of the park-like setting with generous entry distances allows the building's face sign to be larger and out of balance to the station's low roof profile and large overhangs. This location tolerates stronger on-premise signage with an increased scale. Conspicuity and readability are balanced within the established sign composition that contains the store brand. Impulse purchases happen often as the bike / running path attracts many consumers that require replacement of their specialized running / walking appeal, or are attracted to the new product availability.

Store Four: Expansion store 2009

The last expansion store is located within a revitalized urban setting near the downtown area. A renovated building awning and logo bayonet sign announce the store to pedestrians and vehicular traffic. Located in a popular evening entertainment district, this running store attracts persons that would not be visiting the suburban locations. A large wall sign that faces the active evening retail and entertainment area also helps attract customers to the store for impulse and special sales buying.

The building integration is successful in attracting retail sales in its entertainment district location, with the store offering expanded evening shopping hours. The signs are well-organized and the design quality supports the clean, well-manicured building. At this location the signage supports an image and message of quality retail products, and presents a comfortable 'fit' with the adjacent

businesses. As such, it demonstrates an inviting quality that supports its brand identity. Signage in this location has an opportunity to impact sales. Sales are reported to be increasing, and this store and the original store generate the highest sales per month of the four store chain. It is also important to note that other branding activities are utilized less in this location than in the other stores. It can be inferred that the on-premise signage is a major contributing factor to the store's solid sale performance. On–premise signage is the most developed in this location, with the most signs in number and size as compared to the other three locations.

Overall Assessment

At first glance, small specialty businesses such as Bob Roncker's may not seem to offer much in on-premise signage impact. Closer examination provides a greater understanding of the complex variables in on-premise signage and provides a view of a strategic approach to expansion and signage updating, which could be applied to future research involving the analysis of chain retailers. This case study provides a good illustration of how implementation of a branding plan and retail expansion plan that includes on-premise signage can positively impact business performance. According to the Bob Roncker's business manager, Verne Johnson:
"One of our primary goals, since converting our Glendale shop from a New Balance Concept store in 2008, has been on branding the Bob Roncker's Running Spot name. It continued to be a key element in our marketing and advertising programs as we added stores in Loveland, later on in 2008, and Newport in 2009.

"Store signage has no doubt helped us in achieving that goal; improving the image of the Running Spot brand / identity in the greater Cincinnati marketplace. That, along with our continued focus on customer service and quality solution in footwear, apparel, fitness training programs, and other associated running / walking gear has helped us improve our sales performance at all store locations. This target branding strategy has helped make the Running Spot a successful and profitable business for over 30 years and has allowed the brand to expand into four complete stores."

These comments are consistent with the results of a recent national consumer survey that indicates that potential buyers take note of business signage, and make decisions based on it. Nearly three-quarters of respondents reported that they entered a business because signage caught their attention. Similarly almost 80 percent said that they remembered a business later because of the signs. Seventy-five percent of respondents also referred someone else to a business because of notable signage. (FedEx Office, 2012).

Small businesses like the Running Spot depend upon on-premise signage because of the communication value with potential customers. Better economic performance was reported in stores having the most complete and prominent signage. All stores are on healthy economic footing, with the original store and the store in the urban entertainment district showing the best performance. These two stores have the most complete signage package with fresh, legible signs placed in visible locations. While location and signage differences among the four stores preclude a rigorous statistical analysis of the role of on-premise signage in business performance, there

does appear to be a general correlation between superior signage and superior performance. This is also consistent with the business managers' assessment that their signage has resulted in positive performance because it is able to effectively communicate with large numbers of potential customers.

D. Small Business – Chuck Anderson Ford

Chuck Anderson Ford is located in Excelsior Springs MO, which is part of the Kansas City metro area. The business is located within a typical commercial strip on an arterial highway.

In March of 2011, owner Mike Anderson added a new pylon video board to the existing dealership signage, which includes a traditional Ford-logo pylon sign and other business signage. This sign was added primarily as part of an effort to increase the dealership's service business. The new 30-foot pylon sign has a 96-square-foot full-animation, electronic message center. Previously, that portion of the dealership was identified by a 22-square-foot sign that read "Body Shop."

The new sign was not only larger, but it offered better illumination and design, in addition to its messaging capabilities. The electronic sign draws much more attention to Anderson's business.

For example, in 2011, Anderson used the new sign to advertise a corporate tire sale, and even though a Goodyear Tire Center is located directly across the street, Anderson Ford had the fourth-highest tire sales figure among US Ford dealers.

To assess the economic impact of the new sign, Anderson Ford provided monthly data on service department customers and sales for 2010 and 2011. To smooth out monthly fluctuations, the chart below presents the data as two-month averages. Using a base of 100 for the average monthly customer count during 2010, customer figures during 2011 increased from an index of 90 in January and February (the two months prior to adding the new sign) to 108 in the first two months after the new sign and 119 at the end of 2011, showing an average gain of 4.5 percent every two months.

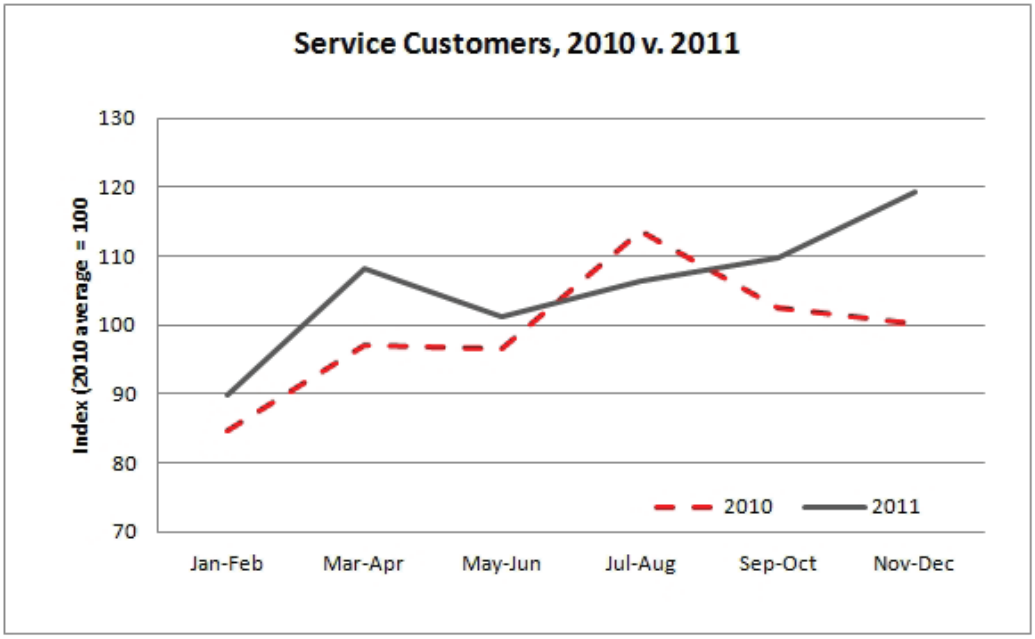


Figure 7: Service Customers, 2010 v. 2011

In figure 7, note that 2011 showed an average year-over-year increase in the number of service customers of 6.5 percent during the ten months after the installation of the new sign.

Mike Anderson indicates that his current service clientele can be identified as 34 percent first-time/new customers and 66 percent regular/repeat customers. This suggests that more customers are learning about his business, and it is reasonable to assume that at least a portion of this new business is coming as a result of the new sign.

A similar analysis was performed on the sales figures, but these numbers were tracked against national auto parts store sales to account for the generally improving national economy. This analysis avoided figures for the winter months (December, January, February) because of the potential for weather-related distortions. Year-over-year figures were compared for the March-to-November periods of 2010 and 2011. This also corresponded well to the introduction of the new sign at Anderson Ford. While US auto parts sales for March-November 2011 were up 5.5 percent over the previous year, Anderson Ford service revenue increased by 10.8 percent in this nine-month period of 2011, compared to 2010. Overall, given the increase in busi-

ness since the sign was installed, Mike has hired three new salespeople, two service technicians and one body-shop person, increasing his employees from 28 to 34, and his business is still growing.

As important as these sales figures are for the dealership, revenue doesn't tell the whole story. The new sign has directly contributed to other positive impacts – on the reputation/brand and visibility of the business. An estimated 30 percent of the new sign's message time is focused on community announcements and public service messages. Examples include:

- Tornado-watch notices,
- The community's annual Oktoberfest,
- A cancer walk-a-thon, and
- Local student recognitions.

These messages generate attention and positive feedback for the business. According to Anderson, "It's about goodwill and being a member of the community. The sign has had a big impact on how we're perceived." When the company first decided to add the new sign, it was seen as an innovative idea that would help to set it apart for its competitors. Now, Anderson says, "The attention I've received has endorsed my decision. The sign has helped us to communicate with the customer on a continual basis. We would for sure do it again!"

VI. Summary of Research Findings

The research shown in this report indicates that appropriately designed and located on-premise signage can be an important factor for retail business success. The implication of these results is that on-premise signage indirectly influences the vitality of a community though the availability of goods and services, jobs and public services. Sign regulations should balance community design objectives with full knowledge of how sign design and location impact businesses success. Business success is important because of its impact on a community's tax base and ultimately leads to the availability of fiscal resources to provide needed services.

We began by providing an intellectual underpinning that uses economic theory to present a new explanation for why on-premise signs have positive economic impacts, not only for businesses, but also for consumers and communities. This explanation can foster more well-informed discussions between sign vendors and users and between sign users and regulators.

The following summarizes this study's findings, based on a national business survey and business cases studies assessing the impact of on-premise signage on business performance.

The national business survey found:

- Legibility is the most important characteristic of signs across all sizes of companies;
- Use of business logos, and the size and location of the signs were more important for companies with more establishments, compared with single establishment companies;
- Sign changes generally had significant, positive impacts on sales, number of transactions, and profits;
- Sign changes had smaller positive impacts on employment.

Among the case studies, positive business performance was generally associated

with on-premise signage changes as the following indicates:

- The national lodging chain case found that the use of a digital electronic sign to display pricing was associated with higher average occupancy rates. The impact appeared to be especially strong for properties with lower occupancy rates;
- The national banking case study found that pylon signs were strongly associated with high visibility; monument signs were moderately associated with high visibility; wall signs contributed to identity but not visibility. In addition, pylon signs were associated with significantly more teller transactions;
- The small specialty store case study demonstrated the need for signage to reaffirm the value offered by a niche retailer. Sign design must be sensitive to community and customer expectations, and able to reinforce the limited brand of a small business. The signage should communicate a "promise" of value for a product and/or service that is not commonly found elsewhere;
- The car dealership case study found that the addition of a video sign board was associated with large increases in both service department revenue and customer count. An added benefit was the "goodwill" and reputational gains associated with using the video board for community-related public service messages.

While many of these findings are statistically significant, larger sample sizes in surveys and case studies should be sought in future research. It is always appropriate to exercise caution when interpreting case study findings because results do not necessarily transfer from one industry or geographic setting to another. While these case study findings about particular individual businesses are not necessarily generalizable, they are important, particularly because the subject is so complex that a comprehensive analysis covering all business types and signage considerations is unlikely to be undertaken. Furthermore, the similarity of some case study findings with survey results suggests that this study deserves careful consideration by researchers, practitioners, and local officials.

VII. Conclusion

The research presented in this report provides current information for better understanding the economic impact of on-premise signage. The national business survey results provide insight to how different types and sizes of businesses use and value their signage. The survey results also provide details about the specific aspects of signs that different types of businesses consider most important. The case study results have reinforced the survey results and provide detailed examples of improved business performance resulting from specific changes in signage. The ultimate goal of this research has been to provide the signage stakeholders with timely, relevant information to inform their decisions about using on-premise signs to jointly serve the needs of both individual businesses and communities where they are located. As we have attempted to convey, the impact of signage on an individual business location is complicated by a number of factors related to the specific physical, social, and regulatory context of that location, as well as the specific customer base and product offered by the business. Our results suggest that careful identification and consideration of those factors is likely to result in more effective signage. The implication is that with respect to on-premise signage, one size does not fit all, and that to maximize their effectiveness, different types and sizes of business need tailor their signs to their specific needs. Most reputable sign companies already know and appreciate this, though this may be new insight for some businesses. Perhaps the stakeholders that can most benefit from our analyses are some of the sign regulators.

Our work should not be interpreted to suggest that all sign regulations hinder business performance. While this research has emphasized the important role of successful businesses in a community's overall quality of life, we recognize that thoughtful signage design standards can accommodate both the needs of businesses and communities. Indeed, it is clear from our work that sign regulation incentivizing legible, visible, and conspicuous signs can boost business performance, especially for the small businesses that can catalyze growth.

A. Implications for Businesses

Businesses make decisions about their signage within the context of their available financial resources, target customer base, and location characteristics. The results

presented in this report emphasize the importance of carefully assessing the role signage plays in a business' overall marketing and branding strategy given the specific characteristics of a particular location. The specific sign designs and types used to achieve these objectives will depend on multiple factors related to the business location, including view distance, street/road curvature, number of traffic lanes, speed limits, landscaping, building setback, and sightline obstructions from other signs, buildings, poles and berms, and potentially many other factors. The case studies reinforce the idea that particular signs may be effective for one type of business but not be well-suited for another. Clearly the digital electronic signs that work so well for the hotel chain would be ineffective for the specialty shoe store. Likewise, the video sign that works well to enhance sales and community relations for a single-establishment car dealer may be difficult for a banking chain to use at neighborhood branches and integrate into their national branding strategy.

B. Implications for Communities

Both private and public decisions about signs can have important implications for communities. As previously indicated, the results of this study show that signs that are legible, visible, and conspicuous are important for retail businesses. The implication is that sign regulations should balance community design standards with site-specific technical requirements for promoting business success. The alternative is that businesses are less successful and governments have less revenue to support their services. Second, it is important for planners and local officials to understand how the purposes and uses of signs differ for single establishments, small companies, and larger companies. Sign regulations that constrain one purpose may disadvantage the businesses that depend on it. This may be the case especially for smaller, single establishments, which are frequently more dependent on signs as a primary means of communicating their location and products or services to potential customers. On the other hand, regulations that encourage quality signage that communicates effectively at low cost may help small businesses. Given that such small businesses frequently serve as engines of job growth, such policies can be especially appropriate as part of neighborhood economic growth strategies.

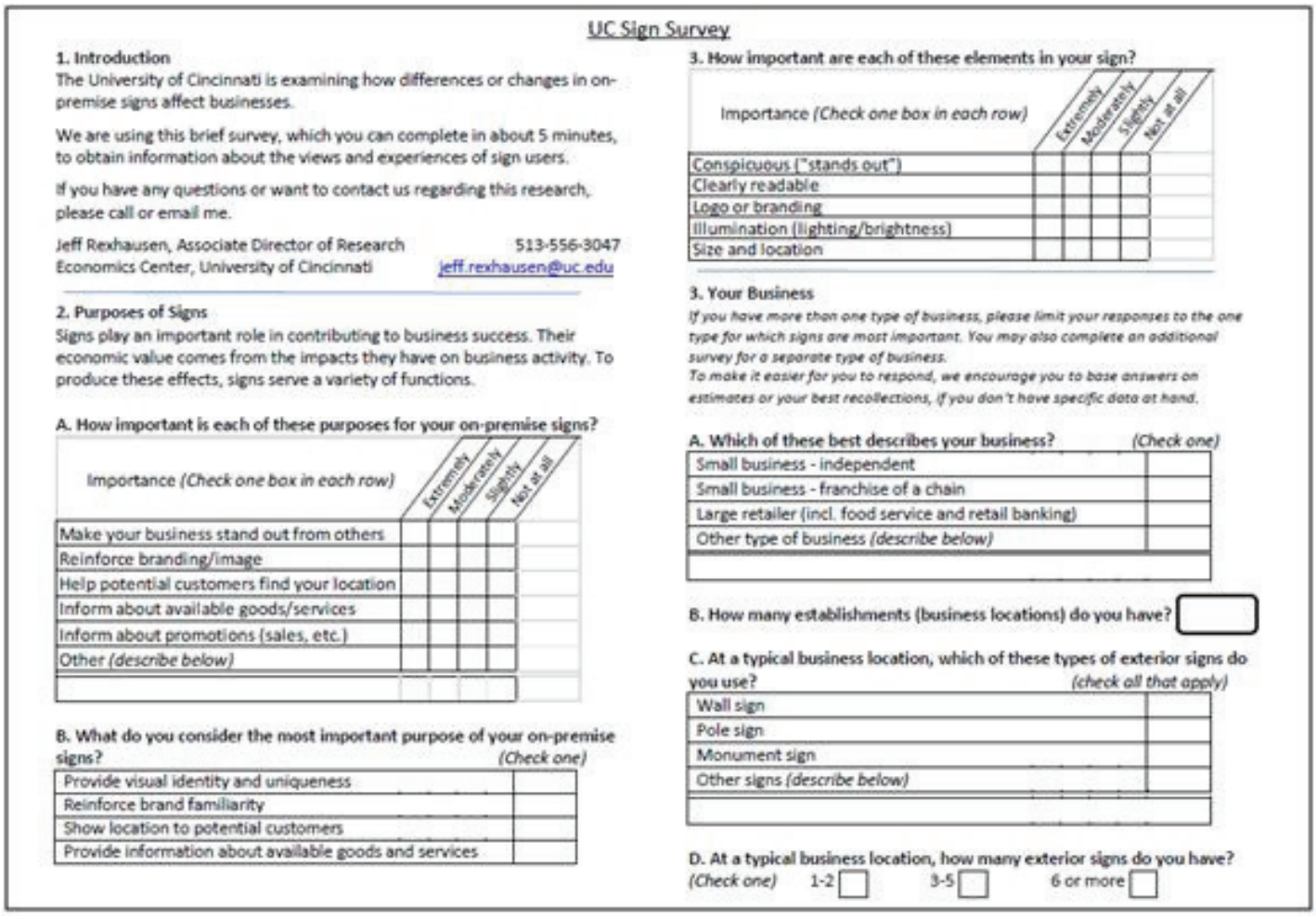
C. Implications for Future Research

Taken together, the results of this research have significant implications for businesses and communities, and they suggest important considerations to guide future research in this area. Much of the work reported here is based on data collected directly from businesses, which are an irreplaceable source of information for signage research. Those who attempt to replicate this research will find that most businesses, regardless of size, are hesitant to share such detailed data about individual locations despite extensive assurances of confidentiality. Because research in this field is important for informing business investments as well as public policy, future research will benefit from efforts that would enable business signage and performance data to be made more accessible to researchers. Associations within the signage industry might be able to establish mechanisms or protocols to facilitate data availability while ensuring confidentiality.

This study can serve as a foundation and guide for practitioners and researchers who want to contribute to the development of more effective signs and improved signage practices. For those who are committed to this collaborative venture, new questions will arise from their application of these research findings, and future research will play a key role in the success of their efforts.

Appendicies

1. Survey Instruments



UC Sign Survey

1. Introduction

The University of Cincinnati is examining how differences or changes in on-premise signs affect businesses.

We are using this brief survey, which you can complete in about 5 minutes, to obtain information about the views and experiences of sign users.

If you have any questions or want to contact us regarding this research, please call or email me.

Jeff Rexhausen, Associate Director of Research 513-556-3047
Economics Center, University of Cincinnati jeff.rexhausen@uc.edu

2. Purposes of Signs

Signs play an important role in contributing to business success. Their economic value comes from the impacts they have on business activity. To produce these effects, signs serve a variety of functions.

A. How important is each of these purposes for your on-premise signs?

Importance *(Check one box in each row)*	Extremely	Moderately	Slightly	Not at all
Make your business stand out from others				
Reinforce branding/image				
Help potential customers find your location				
Inform about available goods/services				
Inform about promotions (sales, etc.)				
Other *(describe below)*				

B. What do you consider the most important purpose of your on-premise signs? *(Check one)*

Provide visual identity and uniqueness	
Reinforce brand familiarity	
Show location to potential customers	
Provide information about available goods and services	

3. How important are each of these elements in your sign?

Importance *(Check one box in each row)*	Extremely	Moderately	Slightly	Not at all
Conspicuous ("stands out")				
Clearly readable				
Logo or branding				
Illumination (lighting/brightness)				
Size and location				

3. Your Business

If you have more than one type of business, please limit your responses to the one type for which signs are most important. You may also complete an additional survey for a separate type of business.
To make it easier for you to respond, we encourage you to base answers on estimates or your best recollections, if you don't have specific data at hand.

A. Which of these best describes your business? *(Check one)*

Small business - independent	
Small business - franchise of a chain	
Large retailer (incl. food service and retail banking)	
Other type of business *(describe below)*	

B. How many establishments (business locations) do you have?

C. At a typical business location, which of these types of exterior signs do you use? *(check all that apply)*

Wall sign	
Pole sign	
Monument sign	
Other signs *(describe below)*	

D. At a typical business location, how many exterior signs do you have?
(Check one) 1-2 ☐ 3-5 ☐ 6 or more ☐

E. Please give a brief description and/or the NAICS or IRS Business Activity Code for your type of business.

4. Sign Changes and Impacts

A. Do you have any business locations at which there have been any of these types of changes to one or more signs in the past 5 years? *(check all that apply)*

Increase in number of signs	
Increase in sign size	
Enhancement of sign visibility (higher, closer to street, placement on building, etc.)	
Change in sign design (refresh look, new type, illumination)	

B. In connection with these sign changes, what business impacts did you experience, and how large were they?

(Check direction and amount of change)	Increase	Decrease	No change	<2.0%	2-4.9%	5-9.9%	10-14.9%	15-19.9%	20% or more	unknown
Total sales volume										
Number of transactions										
Staffing (employment)										
Profits										

C. If sales, staffing, and/or profits increased, what were the top 2 reasons for growth? *(check two)*

New or refreshed signs	
Increased number of signs	
Increased other advertising/marketing	
Increased product/service offerings	
Facilities renovated, refreshed, or expanded	
External factors (the economy, competition, traffic/ accessibility, or temporary circumstances) *(describe below)*	

D. Do you have any business locations at which there have been any of these reductions in signs in the past 5 years? *(check all that apply)*

Temporary loss of a sign	
Permanent loss of a sign	
Reduction in sign size	
Loss of sign visibility (obstructed, lowered, farther from street)	

E. In connection with these sign changes, what business impacts did you experience?

(Check direction and amount of change)	Increase	Decrease	No change	<2.0%	2-4.9%	5-9.9%	10-14.9%	15-19.9%	20% or more	unknown
Total sales volume										
Number of transactions										
Other *(describe below)*										

5. Other Information and Interest in Research Findings

A. Please indicate what types of information you might be willing to share about your sign changes. *(check all that apply)*

Details/stories about types of sign changes	
Data on business impacts (data to be kept confidential; no reference to your business in the study)	
Data on business impacts (data to be kept confidential, but naming your business in the study)	

If so, please provide your phone number and/or email for us to contact you.

B. Would you like to receive a brief summary of the findings of this research project? *(If "yes," please provide email or other address.)*

Yes		
No		

Thank you for contributing to this research. Please invite your business colleagues to also participate.
The more information we receive, the better the insights we will be able to provide in our report. We also welcome your comments and suggestions.

Return survey to: Jeff Rexhausen, Economics Center, Box 0223, University of Cincinnati, Cincinnati, OH 45217-0223

Impact of On-Premise Signs

2. What do you consider the most important purpose of your on-premise signs?

- Provide visual identity and uniqueness
- Reinforce brand familiarity
- Show location to potential customers
- Provide information about available goods and services

Impact of On-Premise Signs

1. Introduction

The University of Cincinnati is examining how differences or changes in on-premise signs affect businesses.

We are using this brief survey, which you can complete in about 5 minutes, to obtain information about the views and experiences of sign users.

If you have any questions or want to contact us regarding this research, please email me at jeff.rexhausen@uc.edu.

Jeff Rexhausen, Associate Director of Research
Economics Center, University of Cincinnati

2. Purposes of Signs

Signs play an important role in contributing to business success. Their economic value comes from the impacts they have on business activity. To produce these effects, signs serve a variety of functions.

1. How important is each of these purposes for your on-premise signs?

	Extremely important	Moderately important	Slightly important	Not at all important
Make your business stand out from others				
Reinforce branding/image				
Help potential customers find your location				
Inform about available goods/services				
Inform about promotions (sales, etc.)				
Other (describe)				

Other:

Impact of On-Premise Signs

2. What do you consider the most important purpose of your on-premise signs?

- ○ Provide visual identity and uniqueness
- ○ Reinforce brand familiarity
- ○ Show location to potential customers
- ○ Provide information about available goods and services

3. How important are each of these elements in your sign?

	Extremely important	Moderately important	Slightly important	Not at all important
Conspicuous ("stands out")	○	○	○	○
Clearly readable	○	○	○	○
Logo or branding	○	○	○	○
Illumination (lighting/brightness)	○	○	○	○
Size and location	○	○	○	○

3. Your Business

If you have more than one type of business, please limit your responses to the one type for which signs are most important. You may also complete an additional survey for a separate type of business.

To make it easier for you to respond, we encourage you to base answers on estimates or your best recollections, if you do not have specific data at hand.

1. Which of these best describes your business?

- ○ Small business - independent
- ○ Small business - franchise of a chain
- ○ Large retailer (incl. food service and retail banking)
- ○ Other type of business

If other, please specify

2. How many establishments (business locations) do you have?

(number)

Impact of On-Premise Signs

2. What do you consider the most important purpose of your on-premise signs?

- ○ Provide visual identity and uniqueness
- ○ Reinforce brand familiarity
- ○ Show location to potential customers
- ○ Provide information about available goods and services

Impact of On-Premise Signs

3. If sales, staffing, and/or profits increased, what were the top 2 reasons for growth?

- ☐ New or refreshed signs
- ☐ Increased number of signs
- ☐ Increased other advertising/marketing
- ☐ Increased product/service offerings
- ☐ Facilities renovated, refreshed, or expanded
- ☐ External factors (the economy, competition, traffic/accessibility, or temporary circumstances)

If "external factors," please specify

4. Do you have any business locations at which there have been any of these reductions in signs in the past 5 years? (check all that apply)

- ☐ Temporary loss of a sign
- ☐ Permanent loss of a sign
- ☐ Reduction in sign size
- ☐ Loss of sign visibility (obstructed, lowered, farther from street, etc.)

5. In connection with these sign changes, what business impacts did you experience?

	Change	% change
Total sales volume		
Number of transactions		
Other		

If other, please specify:

5. Other Information and Interest in Research Findings

Impact of On-Premise Signs

2. What do you consider the most important purpose of your on-premise signs?

- ○ Provide visual identity and uniqueness
- ○ Reinforce brand familiarity
- ○ Show location to potential customers
- ○ Provide information about available goods and services

Impact of On-Premise Signs

1. Please indicate what types of information you might be willing to share about your sign changes. (check all that apply)

- ☐ Details/stories about types of sign changes
- ☐ Data on business impacts (data to be kept confidential; no reference to your business in the study)
- ☐ Data on business impacts (data to be kept confidential, but naming your business in the study)

If you have information, please provide your phone number and/or email so that we may contact you.

2. Would you like to receive a brief summary of the findings of this research project?

- ○ Yes
- ○ No

If "yes," please provide email address.

3. Thank you for contributing to this research. Please invite your business colleagues to also participate. The more information we receive, the better the insights we will be able to provide in our report.

Please go to "http://business.uc.edu/uc-sign-survey-extra" to answer a few more questions about sign impacts.

We also welcome your comments and suggestions.

2. Retail Banking Technical Appendix

To examine the impact of signage and location characteristics on the visibility score, a binary variable taking on a value of 1 if the location received the highest score, and 0 otherwise, was constructed. Assuming that the probability of the outcome of interest is normally distributed gives rise to a standard probit model. As the coefficients from a probit model are not directly interpretable they have been transformed into marginal effects. The marginal effects displayed in the table below give the change in the predicted probability of having the highest visibility rating for a given one-unit change in the explanatory variable.

Dependent Variable: Visibility Score of 5			
Explanatory Variable	Marginal Effect	Coefficient Estimate	z-value of Coefficient Estimate
Number of Signs, by Type			
Pylon	0.91	14.411**	1.99
Monument	0.38	6.010**	1.96
Wall Letters Vertical	0.08	1.314	1.01
Wall Letters Other	0.12	1.959	1.42
Total Square Footage of Signage	-0.003	-0.053*	-1.79
Banking Center Characteristics			
Location	0.43	6.777**	2.09
Accessibility	0.08	1.318	1.15
Parking	-0.08	-1.236	-1.09
Surrounding Area Characteristics			
Land Use Pattern	-0.06	-0.929	-0.95
Life Cycle	0.12	1.822	1.43
Intercept		-35.011**	-1.97
Pseudo R^2		0.7952	

*** significant at the 1% level
** significant at the 5% level
* significant at the 10% level

The measure of banking center performance selected for analysis was the number of average monthly teller transactions in 2011. Because the outcome of interest is a quantity that takes on discrete, nonnegative values, a count regression assuming a negative binomial distribution was used. The functional form assumed that the variance of the outcome was a linear function of the mean. The coefficient estimates are not easily, directly interpretable. The transformed impacts are the estimated change in the number of teller transactions for a one unit change in the corresponding explanatory variable. The estimate for "alpha" appearing in the table below is statistically significant, indicating that the conditional variance of the dependent variable is over-dispersed relative to the conditional mean, confirming the use of a negative binomial distribution as opposed to a Poisson distribution.

Dependent Variable: Number of Average Monthly Teller Transactions

Explanatory Variable	Impact on Monthly Transactions	Coefficient	t-value
Number of Signs, by Type			
Pylon	1.15	0.144*	1.73
Monument	1.03	0.027	0.27
Wall Letters Vertical	1.09	0.084	1.08
Wall Letters Other	1.00	-0.004	-0.09
Banking Center Characteristics			
Location	0.93	-0.071	-1.03
Access	1.09	0.086	1.54
Parking	1.15	0.138**	2.1
Surrounding Area Characteristics			
Land Use Pattern	1.08	0.081	1.25
Life Cycle	1.03	0.03	0.6
Alpha		0.101***	4.91
Intercept		7.981***	21.02
Log-Likelihood		-429.52	

*** significant at the 1% level
** significant at the 5% level
* significant at the 10% level

There are several important potential sources of biases that impact the reliability of the results. As mentioned previously, the datasets analyzed were small and also focused on a single type of business in one industry. The small number of observations may render the point estimates themselves inaccurate. Additionally, there may be important variables that have been omitted from the analyses due to lack of data. These omitted variables may be another source of inaccuracy. It is possible that, where data available, inclusion of these variables would change the sign, magnitude or significance of the remaining variables. Finally, as the data were not a random sample of businesses the results are not necessarily applicable to other industries or indicative of the impacts of business signage generally.

Banking Center Condition Analysis Scorecard

	Score Descriptions				
	5	**4**	**3**	**2**	**1**
Visibility	Location is immediately visible from a great deal of distance and is easily found.	Location is immediately visible and can be seen in the traffic patterns with little difficulty.	Is visible but no more or less than surrounding competitors or retailers.	Is partially visible from the surrounding roadway although obscured by impediment like landscaping or other building.	Building is easily missed when driving by and is likely wholly or partially obscured.
Location	Banking Center is in the prime location within the immediate submarket or trade area. Easily accessible.	Banking Center is in good and visible location within the trade area, although it is not on the prime corner.	Banking Center is serviceable. Its location is generally acceptable and would be easily found by those looking for it.	Banking Center location is flawed in some way (i.e. poor traffic patterns, development moving traffic away from site).	Immediate trade area has moved away from this location or deteriorated in that it is not servicing the customer base.
Access	BC is immediately accessible from either direction from the roadway for both entry and exit. Traffic signal at access. Easy left, in & out.	BC is accessible from either direction although may have shared easement with contiguous retailer. Easy to modestly easy left, in or out.	Is generally accessible, however is susceptible to traffic issues at peak times. Tough to moderately tough left, in or out.	Has some consistent access issues attributable to traffic or easement points. Tough left, in or out.	Access is poor due to constant traffic issues or shared egress points that are far away from BC location. No left, in or out.
Parking	Immediate parking around the banking center is abundant. Plenty of parking even at peak times.	Parking is plentiful. As long as employees park in designated spaces, there is typically enough spaces.	Parking is generally good, however at peak times customers pay have to use surrounding retail for overflow parking.	Parking is tight and at peak times it is likely customers have to wait on spaces.	Inadequate or no designated parking.
Land Use Pattern	Trade area is strong mix of residential, retail and business. Marked by density and high traffic. Compact.	High density and good traffic flows, however, is either retail heavy or residential heavy.	Trade area has strong commuter traffic but is not buoyed by a strong retail cluster. Sprawling.	Trade area is retail destination location. Sometimes termed "On an Island".	Trade area is spread out and not buoyed by a dominant strong traffic path or retail destination.
Life Cycle	Trade area is growing quickly. Expectations for considerable amount of population and retail growth in the immediate area.	Strong trade area. Expectation for modest growth and improving surrounding development.	Mature trade area. Growth has plateaued due to lack of space that constrain further development.	Declining trade area. Demographics are declining and surrounding retail vacancy is increasing.	Trade area is marked with high vacancy of both retail and residential.

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The Team also wishes to acknowledge the many valuable contributions made by SFI Board and Review Team members, the helpful participation of numerous members of the sign industry and businesses that responded to the national survey, and the assistance of the other members of the UC Economics Center staff.

Finally, the Team is deeply indebted to the people of the case study businesses, who provided invaluable information that made this research possible.

SIGN RESEARCH FOUNDATION
EXECUTIVE SUMMARY

NIGHT-TIME BRIGHTNESS LEVEL RECOMMENDATIONS FOR ON-PREMISE ELECTRONIC MESSAGE CENTERS

SIGN RESEARCH FOUNDATION™

Brighter doesn't necessarily mean better. When electronic message centers (EMCs) are unreasonably bright, neither the business nor the community is well served.

"Night-time Brightness Level Recommendations for On-Premise Electronic Message Centers," expanded and re-released in August 2016 by the International Sign Association, explores scientifically researched, easily understandable recommendations for EMC brightness. The report was based on research performed by noted lighting expert Dr. Ian Lewin, past president of the Illuminating Engineering Society (IES).

The most recent version of the report includes the recommended lighting level and model code language, more detailed information on measuring brightness levels with and without operational control, and several case studies.

Proper EMC brightness offers numerous advantages: It conserves energy; it increases the life expectancy of the electronic display components; it prevents glare and it ensures legibility of the display.

It's important to note that EMCs and digital billboards are not synonymous. Each has its own capabilities, purposes, intended audiences and regulations. This document refers only to on-premise EMCs that advertise goods and services available at that particular location. In addition, EMCs use a different lighting technology than most traditionally internally illuminated signs. As such, the recommendations in the report do not apply to other signs such as channel letter and exposed neon.

KEY TAKEAWAYS

This report identifies three key takeaways from "Night-Time Brightness Level Recommendations for On-Premise Electronic Message Centers:"

1 FOR NIGHT-TIME VIEWING, IT IS RECOMMENDED THAT EMC'S NOT EXCEED 0.3 FOOT-CANDLES OVER AMBIENT LIGHTING CONDITIONS WHEN MEASURED AT THE RECOMMENDED DISTANCE, BASED ON THE EMC SIZE.

- EMCs are designed for legibility during daylight, but brightness settings tend to be inappropriate for night-time viewing.
- EMCs may be dimmed manually, through programmed schedules or through photocell technology for night-time viewing.
- Dr. Lewin recommends the development of brightness criteria based on the Illuminating Engineering Society's standards pertaining to light trespass, which involves determining how much light can trespass into adjacent areas without being offensive.

NUMEROUS COMMUNITIES HAVE ADOPTED THE NEW RECOMMENDATIONS WITH GREAT SUCCESS.

- Columbus, Ohio, was receiving complaints about digital sign brightness. City planners explored brightness limits for on-premise and off-premise digital signs, as well as testing methods. Research included an ISA demonstration that showed the impact of different testing methods; one required getting up on a lift and shining a nit gun on the sign, while the other allowed testers to remain on the ground. The new code, based on measurement of foot-candles, has significantly reduced administrative burden.
- Kitsap County, Washington, a transition county between the more rural part of the state and the city of Seattle, crafted regulations that brought stability and made it easy for businesses to convert existing static monument signs into electronic signs. But, they were not written in a way that would allow billboards to convert. ISA provided industry expertise and resources, including the recommended brightness levels.
- Sparks, Nevada, had outdated, less-than-explicit regulations for EMCs; they were also in lumens, which local officials had trouble measuring. As the community continued its rapid growth, the code went under revision, and measurement by both nits and foot-candles was explored. Choosing foot-candles resulted in the use of a simple light meter to measure brightness rather than guesswork.

2

3

NIGHT-TIME BRIGHTNESS CAN BE MEASURED WITH OR WITHOUT OPERATIONAL CONTROL.

- With operational control, the steps include obtaining an illuminance meter; determining square footage; determining the measurement distance; preparing the display for testing; measuring EMC brightness with the illuminance meter; and ensuring that the display can adjust to different ambient conditions. As the display alternates between a solid white message and an "off" message, the tester should note the range of values on the illuminance meter. A reading of less than 0.3 foot-candles is compliant.
- If EMC brightness must be evaluated without access to the sign controls—or if the measurement must be taken after business hours—the process is different. Here, the tester measures the difference in brightness between the sign in operation and when completely blocked from the illuminance meter. The steps include obtaining an illuminance meter; determining square footage; determining the measurement distance; positioning testers with a piece of painted cardboard cut to proper size; using the illuminance meter; and determining the brightness level. If any reading exceeds the maximum brightness level, the sign is non-compliant.

FOOT-CANDLES VS. NITS

More than 250 localities and many state departments of transportation have adopted the foot-candle measurement for EMCs rather than nits. Here's why:

FOOTCANDLES
MEASURES ILLUMINANCE
ACCOUNTS FOR AMBIENT LIGHT CONDITIONS
LUX METER MEASURING DEVICE: ~$100
"TWILIGHT" MEASUREMENT POSSIBLE
MEASURES LIGHT IMPACT AND APPEARANCE
WORKS WITH ROADWAY LIGHTING STANDARDS
EASIER TO CHECK AND ENFORCE

NITS
MEASURES LUMINANCE
MEASURES ONLY THE AMOUNT OF BRIGHTNESS EMITTED
LUMINANCE SPECTROMETER (NIT GUN): ~$1,000
DOES NOT ALLOW ADJUSTMENT BASED ON AMBIENT LIGHT
DOES NOT MEASURE APPEARANCE
DIFFICULT TO MEASURE ACCURATELY
DIFFICULT TO ENFORCE

Read the full report Night-time Brightness Level Recommendations for On-Premise Electronic Message Centers (updated 2016) at: www.signs.org/EMCs

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PHASE 1:
On-Premise Electronic Message Center (EMC) Nighttime Dimming Research Review and State of the Practice Industry Survey

A Research Project Of The
UNITED STATES SIGN COUNCIL FOUNDATION

By
Phillip M. Garvey

The Thomas D. Larson
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Pennsylvania State University

Funded by research grants provided by
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Background and Objectives

If an on-premise electronic message center (EMC) is not set at the appropriate light level for the given ambient brightness (i.e., the level of light around the sign), it will either be too dim, in which case it will not be optimally detectable or legible, or it will be too bright, reducing sign legibility because of overglow or blooming of the sign copy. The goal of this research was to develop appropriate EMC brightness and nighttime lighting level standards through a literature review of existing research and standards and a survey of the EMC industry.

Virtually all on-premise exterior EMC signs being installed today use light-emitting diodes (LEDs) as the source of illumination. LEDs are the current industry standard for the illumination of EMC signs, and it is likely that this will remain so until another technology is perfected that is tolerant to outdoor environmental conditions, sufficiently bright, and cost effective. The research reported here deals only with LED EMC applications, and only those LED EMCs used for on-premise signing; this publication does not deal with so-called "digital billboards" (i.e., off-premise or outdoor advertising EMCs). On-premise signage is an integral part of the wayfinding system that motorists use to safely navigate roadways (Kuhn et al., 1997), while billboards or off-premise signs are predominantly intended to advertise products or services.

The main objective of this research, hereinafter referred to as Phase 1 research, was to determine appropriate EMC brightness as a function of ambient light level (associated with either daytime and nighttime conditions), with particular emphasis on ensuring that these signs are bright enough in daylight and sufficiently dimmed at night and under dark daytime condition to optimize sign visibility. A related objective was to determine the metrics, methods, and procedures to be used to describe EMC lighting levels. To accomplish this, a review of the knowledge base maintained by the United States Sign Council (USSC) and the International Sign Association (ISA) was conducted, along with a review of recent research literature on modern (i.e., LED) EMC lighting levels, and a state-of-the-practice EMC industry survey.

The intended result of this research was an on-premise EMC brightness and nighttime lighting level standard, based on solid science and human factors engineering that would ultimately be incorporated into every EMC manufactured by reputable U.S. manufacturers, and written into local U.S. sign codes. However, as will become apparent, the research findings were not strong enough to support the development of standards that would optimize EMC lighting levels. The result of this report, therefore, includes a detailed proposal to conduct the additional research necessary to develop these standards.

Sign Association Knowledge and Research Literature Review

Overview

This section consists of a review of research and information related to on-premise EMC sign lighting level adjustment that has been created or funded by the two major U.S. sign associations, the United States Sign Council and the International Sign Association, along with the results of a literature review of recent research on current, modern EMC lighting. The latter includes any existing recommendations or proposed standards for on-premise EMC brightness. The reviews focused on three main questions:

1. How are EMC lighting levels best measured and reported?
2. What is the appropriate EMC brightness, given the ambient light level?
3. How much does an EMC need to be "dimmed," or the lighting level adjusted at night?

Lighting Levels for Highway Signs

Changeable message signs (CMS, the highway traffic control device equivalent of EMCs) are required by the Federal Highway Administration (FHWA)'s *Manual on Uniform Traffic Control Devices* to "automatically adjust their brightness under varying [ambient] light conditions" (USDOT, 2009). Two studies of CMS legibility for the FHWA (Dudek, 1991; Garvey and Mace, 1996) made precise photometric recommendations for dimming these signs based on human factors research. Garvey and Mace established a nighttime sign luminance of 30 cd/m^2 (also known as "nits") and 1,000 cd/m^2 for bright daytime viewing, while Dudek's nighttime luminance recommendations ranged from 30 to 230 cd/m^2. However, while these older studies provide useful brightness benchmarks and research methods for the development of appropriate CMS luminance levels, any modern standards for on-premise EMCs will have to be developed using current commercial sign technologies. Unfortunately, to date there have been very few published studies that have looked at this issue.

Sign Associations: The USSC, ISA, and OAAA

The United States Sign Council Foundation (USSCF), the International Sign Association, and the Outdoor Advertising Association of America (OAAA) have independently sponsored research to evaluate the brightness levels of commercial signs. The USSCF has mainly focused on the effects of sign lighting on traditional (i.e., non-EMC) on-premise sign visibility and safety. Most notable was a study to assess the possible impact of on-premise commercial sign lighting on light trespass and glare (Garvey, 2005), and its series of studies conducted by Penn State to compare various lighting technologies (Kuhn et al., 1999), compare the visibility of internally versus externally illuminated signs (Garvey et al., 2004; Garvey et al., 2010), and establish optimal nighttime brightness levels for internally illuminated signs (Garvey et al., 2008). In the 2008 study, the optimum average level of black-on-white sign brightness was 660 cd/m^2

and in the 2010 study, an internally illuminated black-on-white sign set at about the same luminance levels (700 cd/m^2) outperformed an identical externally illuminated sign.

The USSC's first venture into sponsoring EMC research was a literature review (Garvey and Pietrucha, 2005). While this report addressed numerous EMC issues, including color, size, dynamic display, font, safety, and research needs, it only briefly touched on the issue of EMC brightness and nighttime dimming. The two critical statements these researchers made related to this issue were:

1. "Some manufacturers recommend a 50 percent voltage reduction from daytime to nighttime conditions, while others suggest that at night signs should be dimmed to 20 percent of daytime brightness."
2. "The European highway community has been attempting to derive standard optical test methods for CMS for decades, but they have been slowed down by, among other factors, rapidly changing technology. Currently, there are no photometric standards to specify what aspect of the sign should be measured."

The ISA recently sponsored a research project aimed at developing EMC brightness and measurement standards for on-premise sign use (Lewin, 2009). The same researchers conducted a related project for the OAAA for outdoor advertising signs (reported in Lewin, 2008). The ISA technical report (Lewin, 2009) is summarized as a document on the ISA website titled: *ISA Electronic Message Display Brightness Guide*. This document makes the following statements:

1. "Dr. Lewin recommended the development of brightness criteria based on the Illuminating Engineering Society's (IES) well-established standards pertaining to light trespass."
2. "Footcandle [fc] measurements are taken with the sign displaying all white (maximum brightness) and then taken again with the sign switched off."
3. "If the difference is less than or equal to the Eye Illuminance Limit for the particular lighting zone where the display is located, then the display conforms to an appropriate brightness level."

An EMC illuminance of 0.3 fc (3.23 lx) was established. By knowing the measurement distance and the sign area, this can then be converted to EMC luminance (i.e., cd/m^2 or "nits"). Table 1 displays the distances that Lewin recommended for taking the illuminance reading of various size billboards (this is not for on-premise signs), and the resultant luminance standards. On average, the established illuminance level converts to approximately 300 cd/m^2 for all billboard sign sizes (Lewin, 2008). For on-premise signs, Lewin recommended three luminance levels depending on ambient lighting: 108 cd/m^2 for IES Lighting Zone 2; 323 cd/m^2 for Zone 3; and 861 cd/m^2 for Zone 4 (Lewin, 2009). Lewin, however, goes on to state: "*Before adoption of these values, Lighting Sciences Inc. advises that field evaluations of EMC signs should be conducted to verify that such levels produce the desired attention-gathering legibility and public acceptance*" [original italics].

Table 1. Recommended illuminance measurement distances and proposed luminance standards for various size billboards.

Billboard Size	Billboard Dimensions (ft)	Measurement Distance (ft)	Luminance cd/m^2
Small	11 x 22	150	300
Medium	10.5 x 36	200	342
Large	14 x 48	250	300
Very Large	20 x 60	350	330

Analysis

While Lewin states that EMC nighttime dimming has to allow for "adequate brightness for clear visibility," the basic premise behind his recommendations to both the OAAA and the ISA is that EMCs should not exceed the illuminance levels set in place by the IES to control for light trespass, even though, as Lewin wrote, "Digital signs are not the form of lighting that [the Illuminating Engineering Society of North America, IESNA's] TM-11-00 was developed to address. In fact, digital signs are specifically intended to be seen over a wide area, much of which may be remote from the sign itself" (Lewin, 2009). Lewin himself conducted no objective visibility studies to ensure that the recommended levels resulted in "adequate brightness for clear visibility," stating only: *"By experience and through field evaluation* [by Dr. Lewin's and ISA's staff members]*, luminance levels of this order have been found to produce highly acceptable legibility, conspicuity and visibility, while avoiding over-brightness"* (Lewin, 2009) [original italics].

Furthermore, the selection of an illuminance (fc) metric to define appropriate sign lighting level is a questionable decision. While it is true that illuminance meters are a good deal less expensive than luminance meters, the latter have several advantages over the former:

1. Luminance is independent of sign size and viewing distance, so, unlike with illuminance, it would not be necessary to know the sign area or establish "somewhat arbitrary" measurement distances (Lewin, 2009) when taking field measurements.
2. Luminance, not illuminance, is the photometric equivalent of brightness and therefore is the metric associated with sign visibility.
3. Luminance meters are not affected by changing ambient light such as vehicle headlamps, while illuminance meters are.
4. Depending on the level of ambient light, illuminance meters may not be sensitive enough to distinguish between measurements taken with the "sign on" and the "sign off."
5. Luminance is the standard used by EMC manufacturers in specifying sign lighting levels.
6. Both IESNA and the International Commission on Illumination (Commission internationale de l'éclairage, or CIE) specify road sign lighting in terms of luminance values (Wachtel, 2009).
7. According to 3M: "luminance is the best measure available to judge relative sign brightness" (from Wachtel, 2009).

NEMA Standards for EMC

In 2005, the National Electrical Manufacturers Association (NEMA) Standards Publication TS-2005, "Hardware Standards for Dynamic Message Signs (DMS) with NTCIP Requirements," was published (NEMA, 2005). This document provides consensus standards for the luminance of DMS and their measurement that are consistent with the techniques and findings of earlier FHWA research conducted on CMS (Garvey and Mace, 1996) and are the standards used by the FHWA for highway CMS. While designed for highway signs, they can be applied to on-premise EMCs (not all EMC applications are "commercial"—many are at schools, municipalities, hospitals, etc.).

Measurement Area

When taking a luminance reading of a sign, "the whole of the optical test area must be fully populated with elements, must be a minimum size of 100 x 100 mm, and must contain at least 5x5 = 25 elements" (NEMA, 2005). This is illustrated in Figure 1.

Lighting Levels

The standard states that DMS "shall control pixel illumination with an automatic dimming system. The system shall adjust the light output to predefined brightness levels in accordance with ambient light conditions." Tables 2 and 3 contain NEMA's minimum and maximum sign luminance values for light-emitting signs (e.g., LEDs) as a function of ambient illumination from bright daylight (40,000 lx) to nighttime (less than 4 lx). Table 2 shows this for signs set on all white, and Table 3 shows these values for monochromatic "red" signs.

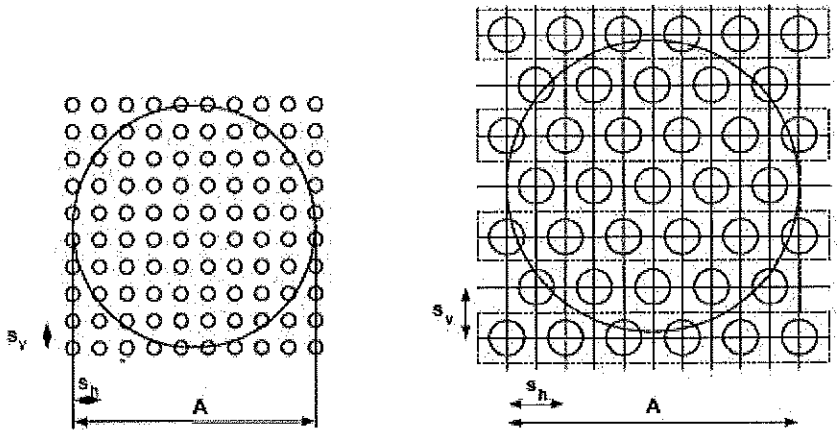

Figure 1. Positioning of the test area for EMC luminance measurement (NEMA, 2005)

Table 2. Recommended sign luminance (cd/m^2) as a function of ambient illuminance (lx) for white EMC (NEMA, 2005).

Sign Illuminance (lx)	Recommended Sign Luminance (cd/m^2)	
	Minimum	Maximum
40,000 (bright daylight)	12,400	62,000
4,000	2,200	11,000
400	600	3,000
40	250	1,250
Less than 4 (nighttime)	75	375

Table 3. Recommended sign luminance (cd/m^2) as a function of ambient illuminance (lx) for monochromatic red EMC (NEMA, 2005).

Sign Illuminance (lx)	Recommended Sign Luminance (cd/m^2)	
	Minimum	Maximum
40,000 (bright daylight)	3,100	15,500
4,000	550	2,750
400	150	750
40	63	313
Less than 4 (nighttime)	19	94

ILE Guidelines

While not specifically addressing EMCs, the Institution of Lighting Engineers (ILE) published guidelines for "establishing suitable levels for illuminated advertisements" and field measurement procedures to ensure that the signs comply with the established sign luminance guidelines (ILE, 2001). The measurement procedure specifies using a luminance meter with a 1.0-degree aperture, taking the readings at night, and ideally at right angles to the sign face and "a distance appropriate to the measuring field." The recommended maximum luminance levels were not based on sign visibility, but rather (like Lewin's research) on environmental zones and sign size. The goal was to establish an "acceptable degree of subjective brightness" that "can be achieved without detrimental effects to amenity and public safety." Smaller signs (up to 10 m^2) are allowed luminance levels of 100, 600, 800, and 1,000 cd/m^2 for zones 1-4 respectively and larger signs 300, 600, and 600 cd/m^2 for zones 2-4 (assuming that no larger signs would be allowed in zone 1).

IESNA Guidelines and Recommended Practices

In the 1990s and early 2000s, IESNA published a number of guidelines and recommended practices for sign lighting (IESNA, 2001) and its measurement (IESNA, 1998), including commercial signs (IESNA, 1993). Unfortunately, these documents are not applicable to the establishment of modern EMC daytime lighting levels, nighttime dimming, or photometric measurement.

Recent Research Documents

Rensselaer Polytechnic Institute's Lighting Research Center was hired by NYSDOT to measure the luminance of standard static billboards (RPI, 2008). The purpose of this was to establish baseline maximum luminance levels that could then be applied to electronic billboards. The results were daytime and nighttime luminance maximums of 5,000 and 280 cd/m^2, respectively. In the process, RPI also established measurement techniques that could be used on both static and electronic billboards. These are very similar to those recommended by NEMA (2005) and ILE (2001):

- Take measurements at right angles to the sign.
- Luminance meter should have 1 degree or smaller aperture.
- Measure from approximately 50 ft from the sign (a 1-degree aperture will capture a 10-inch-diameter portion of the sign at this distance).
- Take measurement while the sign display is "white."

In 2009, Australia's Queensland Government published a guidance document for "roadside advertising" (Queensland Government, 2009). Although the document specifically stated: "Guidelines for the management of Category 1 electronic billboard Advertising Devices are currently under development," it did establish maximum nighttime luminance levels for illuminated advertising in general. The authors note: "The maximum luminance levels ... were determined following field investigations." The maximums were again based on environment zones, with maximum sign luminance in zone 1 = 500 cd/m^2; zone 2 = 350 cd/m^2; and zone 3 = 300 cd/m^2. (They define "environment zones" in the reverse order of the IES and ILE, with zone 3 being low levels of ambient light and zone 1 being high.) The luminance measuring methodology is close to that recommended by RPI and others; however, because it was developed for static billboards, it is not reproduced in this document.

Jerry Wachtel (2011) published a paper that addressed digital billboards (DBBs) and traffic safety. Wachtel discussed the automatic "moth effect" related to the attraction of the human eye to bright lights, and the placement of billboards where they will attract the greatest driver attention (e.g., intersections, horizontal curves, etc). Wachtel also discussed possible increased distraction related to more advanced DBB technology available now, or on the horizon, including: personalized messages, interactive displays, facial recognition, and automatic license plate recognition. He also provides recommendations on how to design and place DBBs so they will be minimally distracting to drivers. These are:

1. *Control the Lighting* – The author recommended "adopting a measurement protocol and setting an upper luminance."
2. *Lengthen Dwell Time* – The author recommended ensuring "that no motorist will see more than one message change."
3. *Keep it Simple* – The author recommended ensuring "minimum standards of legibility" and reducing complexity of the message.
4. *Prohibit Message Sequencing* on a single sign, or an array of signs.

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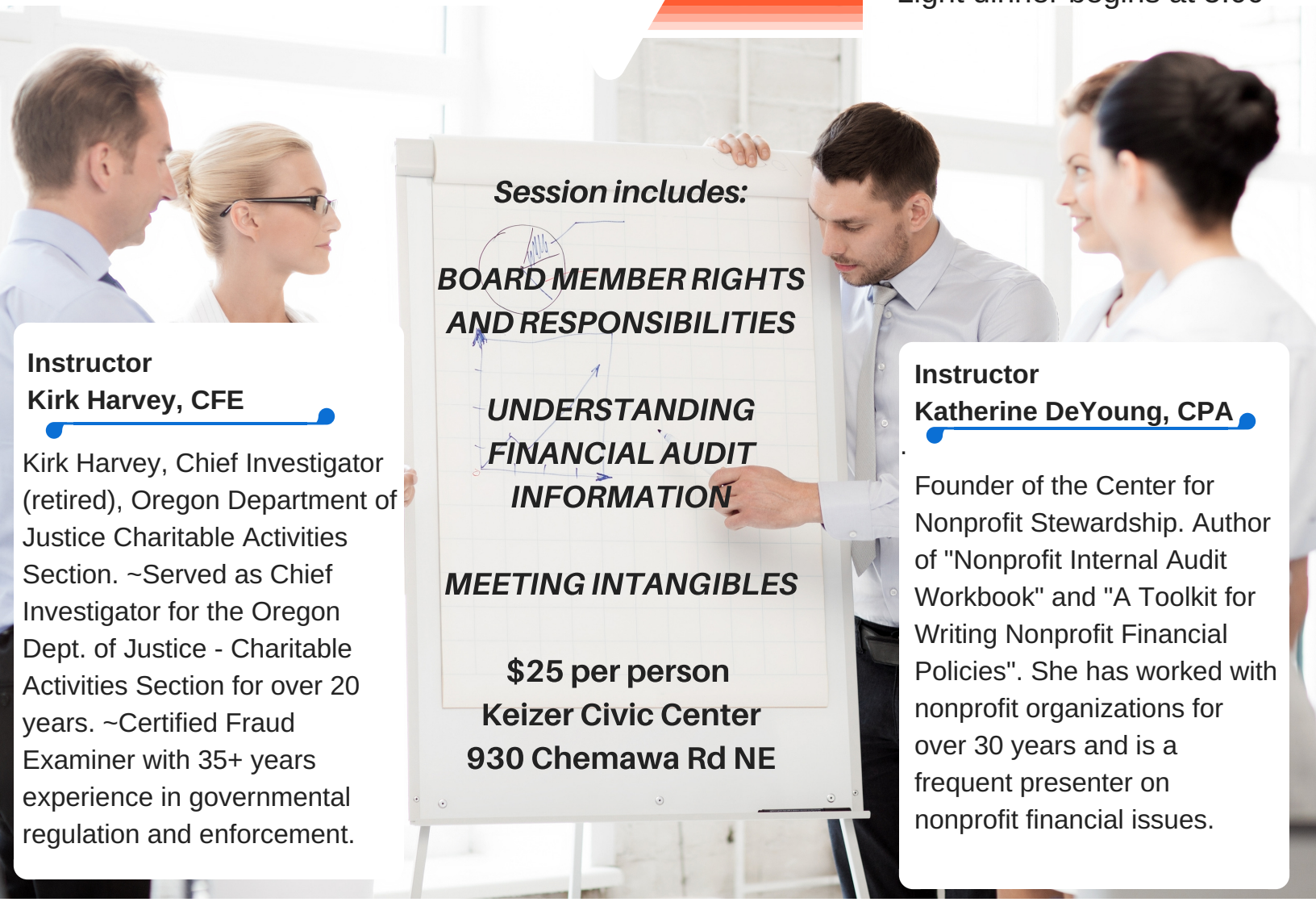

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Founder of the Center for Nonprofit Stewardship. Author of "Nonprofit Internal Audit Workbook" and "A Toolkit for Writing Nonprofit Financial Policies". She has worked with nonprofit organizations for over 30 years and is a frequent presenter on nonprofit financial issues.

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Harms, Tammie

From: Lockhart, Debbie
Sent: Wednesday, March 14, 2018 3:45 PM
To: Amy Ryan; B. Kerr; Bill Peterson; Bruce Anderson; Cathy Clark; Jeff Cowan; Eppley, Christopher; Chris Hitchcock; Colleen Busch - Transit District; Crystal Wilson; Danielle Bethell; Darrell Fuller; Garry Whalen; Hersch Sangster; Isaac Matthews; Jacque Moir; James Willhite; Jason Cohee; Josh Eggleston; Keizetimes Editor; Ken Gierloff; Keri Miller; Kim Freeman; Kim Lewis; Kyle Juran; Laura Reid; Lawyer, Bill; Linda Doerfler; Lynne Tognoli; Marlene Parsons; Matt Lawyer; Michael DeBlasi; Brown, Nate; Phillip Wade (K-23) (Phillip@KeizerTV.com); Rhonda Rich; Roland Herrera; Russell, Dina; Sandy Kerr; Johnson, Shannon; Shelly Ehenger; Cherriots Salem Keizer Transit; Harms, Tammie; Witham, Shane
Subject: FW: Window coverage

Received this afternoon regarding the public hearing tonight. (See below)

Debbie Lockhart, MMC
Deputy City Recorder
City of Keizer
503-856-3418

-----Original Message-----
From: Beth Teske [mailto:b.teske@jckstar.com]
Sent: Wednesday, March 14, 2018 3:30 PM
To: Lockhart, Debbie <LockhartD@keizer.org>
Cc: l.karcher@jckstar.com
Subject: Window coverage

Hi, my name is Beth Teske and I am representing Jersey Mikes. I am unable to attend the meeting this evening but wanted to put in my input. The main reason we have a lot of our windows covered is that area is our dry storage. So if it was uncovered you would see the back of our freezer, refrigerator, and dry storage shelves. Also insulation and water lines for our soda machine. Nobody would find any of those things fun to look at. I understand that having the usable windows such as in the lobby space mostly uncovered is a good idea, but they need to look at the big picture that some of the windowed areas are storage areas and need to be covered so they look better to the public. I feel like making us uncover them would make for a huge eye sore for the community.
Thanks for taking time to listen to my opinion.

Beth Teske
Jersey Mikes

Sent from my iPhone

Sent from my iPhone

IJ

INSTITUTE FOR JUSTICE

RECEIVED
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November 15, 2017

Shannon Johnson
P.O. Box 21000
Keizer, OR 97307

RE: Proposed Amendments To The Sign Code

Dear Ms. Johnson,

My name is Erica Smith and I am an attorney at the Institute for Justice, a national nonprofit public-interest law firm that fights on behalf of those whose free speech rights are threatened by the government. We are writing to you because we were recently informed that you are deliberating amendments to your sign code. We have attached our model sign code for your consideration that we hope you will rely on in amending your code.

This model sign code serves as a guide to municipalities who wish to bring their codes into constitutional compliance following the Supreme Court's recent decision about sign codes in *Reed v. Town of Gilbert*, 135 S. Ct. 2218 (2015), which is discussed more below. This model sign code is also designed to allow individuals and businesses to enjoy maximum free speech protections.

Speech-friendly sign codes are not only constitutionally mandated, but good policy. Signs are a crucial way for individuals and businesses to communicate because they are cheap, easy, and effective. Consumers also appreciate signs that allow them to more easily find their intended destinations and learn about businesses in their community. We therefore hope that you will seriously consider adopting all or part of this model code.

About the Institute for Justice

The Institute for Justice ("IJ") is a national, nonprofit public-interest law firm that fights on behalf of those whose rights are threatened by the government. One right that IJ protects is the First Amendment right of individuals and businesses to freely speak out, including through the use of signs. For over twenty years, IJ has successfully brought

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general@ij.org www.ij.org

free speech suits against sign code restrictions in federal courts across the country.[1] IJ has also persuaded other cities to amend their sign codes in order to avoid litigation.[2]

IJ increased its focus on sign codes in 2015, after the U.S. Supreme Court issued its ruling in the sign case, *Reed v. Town of Gilbert*, 135 S. Ct. 2218 (2015). The Court's decision in *Reed* means that most of the thousands of municipal sign codes throughout the country are now constitutionally suspect. In the wake of *Reed*, many municipalities have tried to cure the problems in their sign codes, only to find that more infirmities remain. Meanwhile, other municipalities are paralyzed by the prospect of reforming overgrown sign codes—some of which have reached more than 40 pages in length.

To aid these municipalities, the Institute for Justice ("IJ") drafted a model sign code. Incorporating best practices from cities around the United States, the model code's goal is to help municipalities successfully navigate the post-*Reed* landscape while making it easier for their citizens to advertise their businesses and speak out about the issues they care about the most.

Reed v. Town of Gilbert

Reed is essential reading for every municipal attorney. In its opinion, the Supreme Court made clear that sign codes that draw "content-based" distinctions are presumptively unconstitutional. A content-based distinction is one based on subject matter or message. Thus, a sign regulation is content-based and presumptively unconstitutional if an official must read a sign in order to determine if or how the regulation applies to it. Instead, signs can only be regulated by their structural characteristics.

Reed began with a small community church that lacked a permanent home. Because the church's services moved from week to week, it put out signs in the roadway so parishioners could find their congregation. But the Town of Gilbert, Arizona began to cite the church for its directional signs, even confiscating them. Gilbert claimed that the church's signs were too large and were up for too long according to its sign code. But that same sign code allowed temporary signs about other subjects, such as elections or social issues, to both be larger and remain up longer.

Frustrated by this second-class treatment of its First Amendment rights, the church sued Gilbert, arguing that the town's sign code played favorites with different kinds of messages and thus violated its free speech rights. Gilbert argued in response that because its goal was to protect public safety and aesthetics rather than suppress anyone's

[1] *See, e.g.*, *Cent. Radio Co., Inc. v. City of Norfolk*, 811 F.3d 625 (4th Cir. 2016); *Neighborhood Enters., Inc. v. City of St. Louis*, 644 F.3d 728 (8th Cir. 2011); *Pagan v. Fruchey*, 492 F.3d 766 (6th Cir. 2007); *Ballen v. City of Redmond*, 466 F.3d 736 (9th Cir. 2006).

[2] *See, e.g.*, *Fears v. City of Sacramento*, Civ. No. 2:13-cv-01667 (E.D. Cal. Aug. 29, 2013).

speech, its sign code could constitutionally treat certain messages less favorably than others.

In a forceful opinion, the Supreme Court rejected Gilbert's argument. The Court held that Gilbert's sign code was "content based" because it treated signs differently based on their message. It did not matter, said the Court, that such distinctions were enacted for a benign purpose. As a result, the Court held that the code was presumptively unconstitutional and could survive only if it met the most rigorous form of judicial review, known as "strict scrutiny." *Reed*, 135 S. Ct. at 2218. The Court held that Gilbert's code failed strict scrutiny because restricting signs with certain messages more than others was not narrowly tailored to further the town's claimed interests.

The Court's decision rests upon bedrock principles of First Amendment law: Since the 1970s, the Supreme Court has consistently said that laws that by their terms discriminate based on subject matter are constitutionally suspect. But many lower courts failed to apply this principle to sign codes. Now with *Reed*, that principle has been reinforced across the nation to resounding effect. The net result is that any sign code that discriminates between signs based on their message or subject matter will almost certainly be held unconstitutional.

The Institute for Justice's Model Sign Code

Many municipalities want to do the right thing and bring their sign codes into constitutional compliance but are overwhelmed as to how to proceed. The Institute for Justice wishes to help. This model sign code reflects best practices in the world of signs and has been thoroughly vetted by attorneys with extensive experience in both consulting and litigating on the issue.

Rather than completely replace existing sign codes, this model serves as a template for those sections of sign codes that most often raise constitutional concerns. These include select definitions, (such as for the definition of "sign"), regulations for temporary signs, permit exemptions, and restrictions on murals. These portions of many current sign codes make distinctions based on subject matter, message, or "purpose," and, as a result, have repeatedly subjected municipalities to costly and lengthy litigation. The model thus shows how these provisions can instead regulate signs' structural characteristics, rather than their content.

This model also recognizes that municipalities are not all alike, and that many towns and cities will want some flexibility to customize their sign codes. So rather than demand a one-size-fits-all approach, this model instead leaves certain criteria (such as certain sign's maximum size and how long those signs may stay up) open, so that local officials may insert restrictions that they believe best make sense in light of the unique needs of their community. IJ, however, strongly encourages municipalities to be as

accommodating as possible to its citizens and businesses when it chooses these restrictions.

IJ additionally urges municipalities to be reserved in any additional customization. In our experience, local officials often give in to the temptation to play favorites with certain types of speech—yet even one content-based restriction in a code can make the municipality vulnerable to a lawsuit.

***

Please do not hesitate to ask me any questions. We are also happy to assist you in your sign code amendments in any way we can. My phone number is 703-682-9320 and my email address is esmith@ij.org.

Sincerely,
Erica Smith*

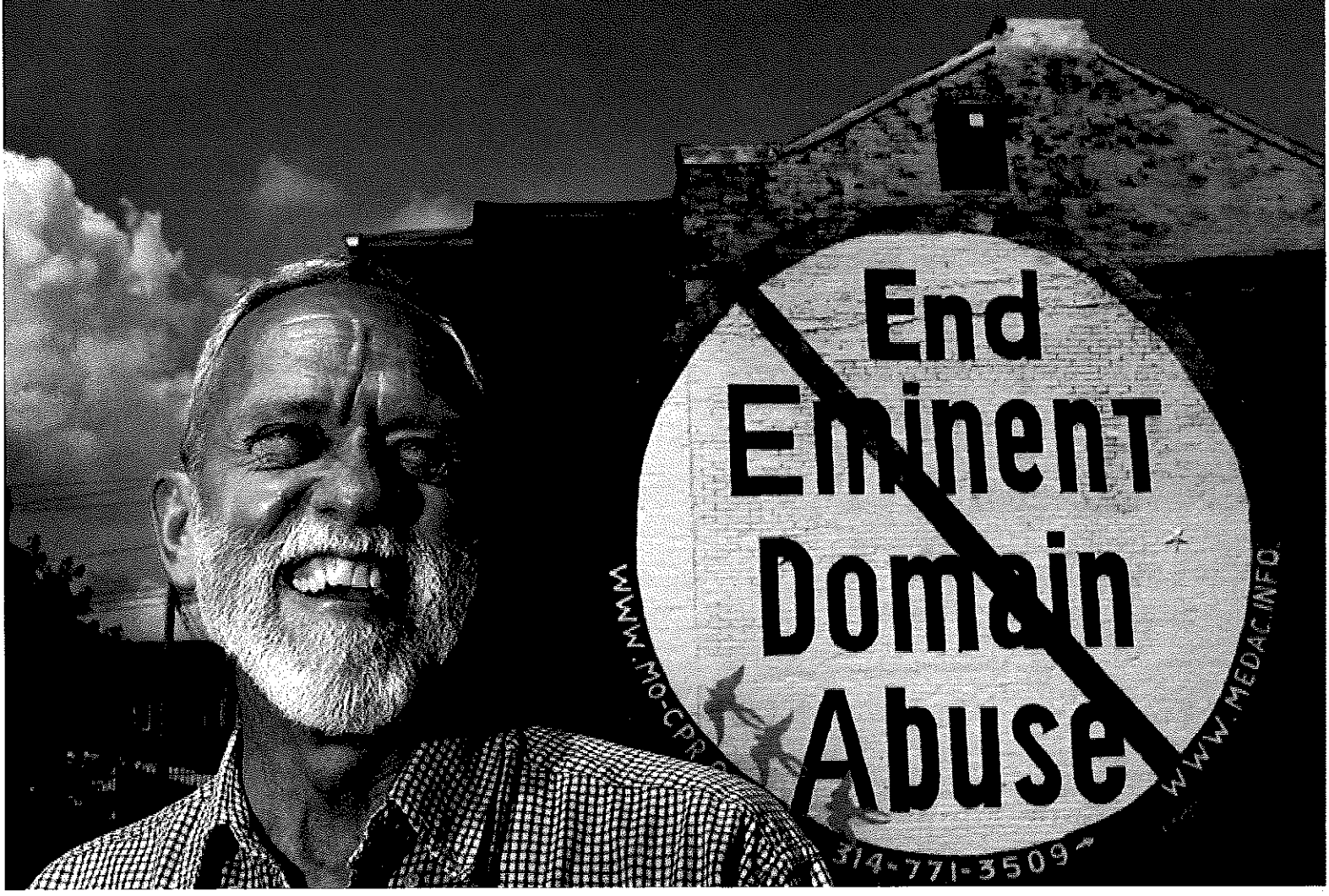
Attorney

*Licensed in New York.

Enclosures: Model Sign Code

The Institute for Justice's MODEL SIGN CODE

INSTITUTE for JUSTICE



The Institute for Justice's
MODEL SIGN CODE

http://ij.org/activism/legislation/model-legislation

Many municipalities want to do the right thing and bring their sign codes into constitutional compliance but are overwhelmed as to how to proceed. The Institute for Justice wishes to help. This model sign code reflects best practices in the world of signs and has been thoroughly vetted by attorneys with extensive experience in both consulting and litigating on the issue.

Rather than completely replace existing sign codes, this model serves as a template for those sections of sign codes that most often raise constitutional concerns. These include select definitions (such as the definition of "sign"), regulations for temporary signs, permit exemptions, and restrictions on murals. These portions of many current sign codes make distinctions based on subject matter, message, or "purpose," and, as a result, have repeatedly subjected municipalities to costly and lengthy litigation. The model thus shows how these provisions can instead regulate signs' structural characteristics, rather than their content.

This model also recognizes that municipalities are not all alike, and that many towns and cities will want some flexibility to customize their sign codes. So rather than demand a one-size-fits-all approach, this model instead leaves certain criteria (such as certain sign's maximum size and how long those signs may stay up) open, so that local officials may insert restrictions that they believe best make sense in light of the unique needs of their communities. IJ, however, strongly encourages municipalities to be as accommodating as possible to its citizens and businesses when it chooses these restrictions.

IJ additionally urges municipalities to be reserved in any additional customization. In our experience, local officials often give in to the temptation to play favorites with certain types of speech—yet even one content-based restriction in a code can make the municipality vulnerable to a lawsuit.

I. Model Definitions:

Definitions in sign codes play a large role in determining whether someone's proposed sign will be unregulated or instead subject to the code's requirements and restrictions. To ensure that cities do not privilege some messages over others, IJ suggests that municipalities incorporate the following definitions into their sign ordinance.

Sign: Any device, display, or structure that is visible from a public place and that has words, letters, figures, designs, symbols, logos, illumination, or projected images. This definition does not include architectural elements incorporated into the structure or facade of a building. For the purposes of this sign code, "signs" do not include those only visible from the inside of a building or athletic field/stadium; nor do "signs" include those held by or attached to a person.

Temporary sign: A sign constructed of cloth, canvas, vinyl, paper, plywood, fabric, plastic, or other lightweight material that is neither permanently installed in the ground nor permanently affixed to a building or structure that is permanently installed in the ground. The term "temporary sign" includes, but is not limited to, A-frame signs, lawn signs, banners, inflatable signs, and window signs. The term "temporary sign" does not include flags, and signs that are intended to regularly move, such as motorized signs.

Mural: A painted image or design on a building, which may or may not include words. The definition of "mural" does not encompass architectural elements that are incorporated into a building's structure or facade.

Flags: A sign made of cloth, vinyl or a similar pliant material that is attached on one side to a flagpole and is designed to flow in the wind.

Window sign: A sign that is applied or attached to or suspended from the exterior or interior of a window or located within the interior of a structure so that its message can be read from the exterior of the structure.

A-Frame sign: A sign consisting of two (2) sign faces placed together at an angle to form an "A" shape structure which tapers from a wide base to a narrow top. A-frame signs are sometimes referred to as sandwich board signs.

Nonconforming sign: Any sign which was lawfully erected in compliance with the applicable regulations of the zoning ordinance prior to the effective date of this chapter and which fails to conform to the current standards or restrictions, the use of which has not been discontinued for longer than two (2) years.

Dubious definitions: Sign codes' definitions of a "sign" often exempt favored displays like government flags and religious symbols—allowing these displays to be unregulated while other displays are strictly governed. Such content-based exemptions have been repeatedly struck down by courts and should be immediately removed from sign codes.

II. General Provisions:

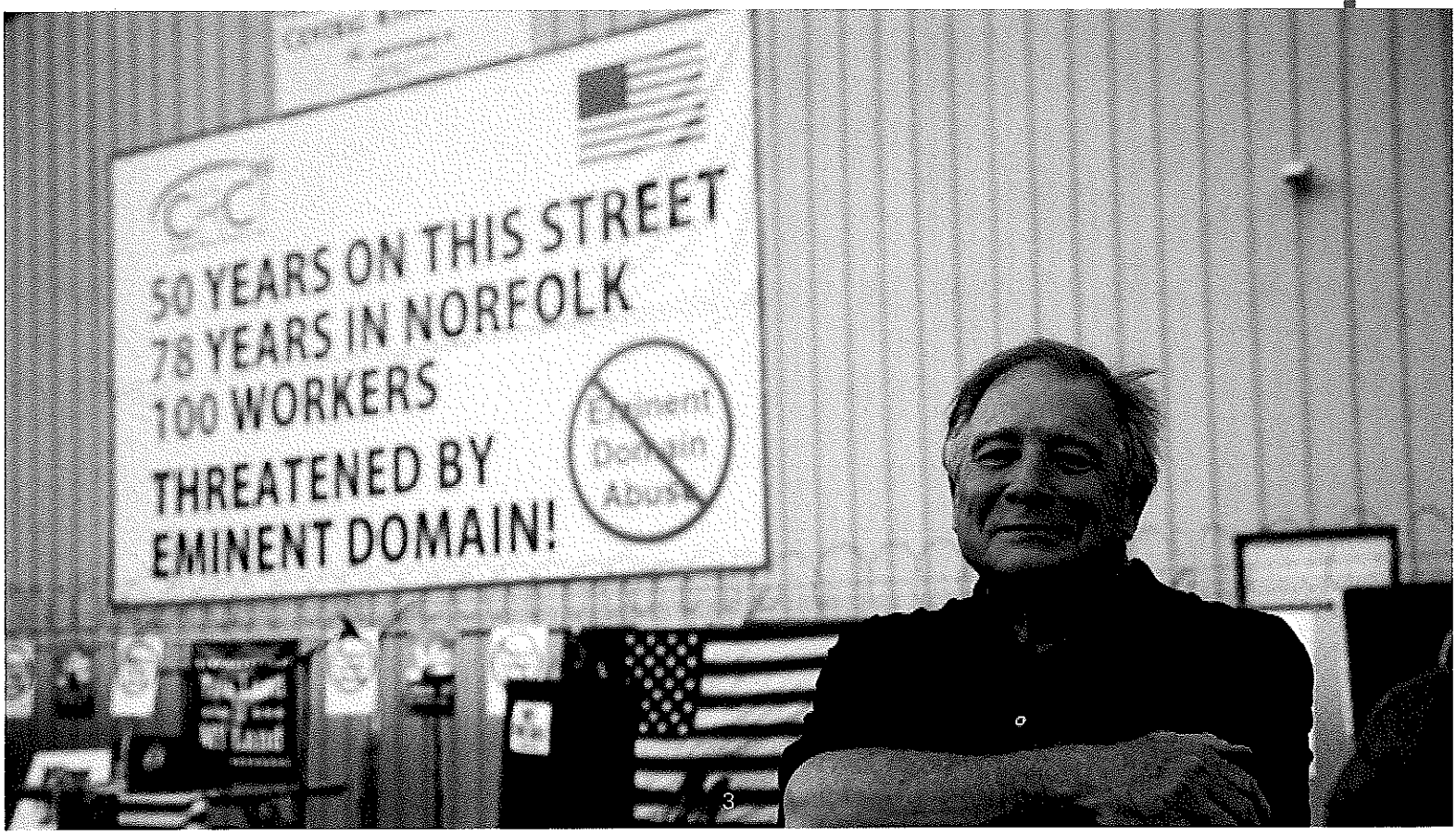
Because the government cannot constitutionally dictate what content may be displayed on a sign, and because the purpose of a sign code is to safeguard citizens from the structural elements of signs, residents and businesses should be able to change the message on their approved signs as they see fit. Moreover, because the freedom to speak freely is fiercely protected under the U.S. and State Constitutions, municipalities should take care that their sign codes do not inadvertently restrict speech.

A. Any ambiguity in this sign code should be resolved in favor of allowing the display of a proposed sign.

B. Any person who displays a sign in compliance with this code may substitute the message on that sign without first securing any additional approval, permitting, or notice, provided that any such substitution would not result in the sign becoming noncompliant.

C. Nothing in this code is intended or shall be construed so as to prevent the strengthening or restoration to a safe condition of a nonconforming sign for purposes of the public health and safety.

IJ client **Bob Wilson** was being blocked by the city of Norfolk, Va., from displaying a banner protesting eminent domain abuse.



III. Permitting:

Just as with the definition of "sign," many jurisdictions' permitting regimes impermissibly play favorites with the First Amendment by exempting certain subjects and messages from either having to secure a permit or from paying otherwise applicable fees. The better approach is for municipalities to require permits for signs whose physical characteristics raise potential health and safety concerns, while exempting innocuous temporary signs and murals from the permitting process.

> *In addition, signs are a valuable means of communication because they are cheap and can be quickly deployed. Municipalities should make sure that their permitting regime does not frustrate those key advantages by imposing numerous steps, high fees, and substantial delays.*

The primary purpose of the City's permitting process is to protect the public's health and safety by ensuring that signs with structural elements that could pose a health and safety risk are properly installed.

Permit Headaches: Municipal officials frequently cause unnecessary conflict when they insist that signs must be removed because they lack a permit. This has led to community strife and even litigation. Both are easily preventable by allowing unpermitted signs to remain on display (as long as they are otherwise legal) until their owners secure permits.

A. All signs not otherwise exempted from the permit requirement must obtain a permit prior to display.

B. All permit applications that comply with this sign code shall be granted.

C. Time for permit application approval:

1. If this sign code does not require a requested sign to have an inspection, permit applicants should receive a decision on their permit application within two business days of submitting the application.

2. If the code does require a requested sign to have an inspection, permit applicants should receive a decision on their permit application within [*insert number of days*] business days of submitting the application.

    a. The permit shall be issued conditional to inspection passage.

The inspection shall be conducted after sign installation.

D. Permit Noncompliance:

1. If a sign lacks a required permit but is otherwise permitted under the sign code, the sign's continued display shall be allowed as long as the sign owner applies for a permit within 7 business days.

E. Permit Not Required

1. In addition to signs exempted from the permitting requirement in [insert section], permitting shall not be required for the following:

    a. Changing sign content.

    b. The customary maintenance of any sign.

IV. Signs Exempted from Permit Requirement:

Because the purpose of regulation is to safeguard the public's health and safety from the structural elements of signs, persons who wish to communicate using temporary signs should not be required to go through the arduous process of securing a sign permit.

The signs in this section do not require a sign permit, shall not be counted against any maximum sign allotment for a particular property, and are not subject to other restrictions in the sign code, except the Prohibited Sign section at [*insert section*]. These exempted signs are:

A. All temporary signs on private residential property that are smaller than [*insert size*] square feet.

All temporary signs on private commercial property.

B. All temporary signs on private industrial property.

C. All temporary signs on private agricultural property.

D. All flags, subject to the following:

1. Residential zones

    a. Flags shall not exceed [*insert size*] square feet in area.

Flag poles shall not exceed [*insert size*] feet in height, as measured from the ground.

2. Commercial zones

    a. Flag poles in commercial zones shall not exceed [*insert size*] feet in height, as measured from the ground.

3. Industrial and Agricultural zones

    a. Flag poles in industrial zones shall not exceed [*insert size*] feet in height, as measured from the ground.

4. Flag poles may be erected vertically or, alternatively, may be attached to buildings horizontally or at an angle.

All inflatable signs that are safely attached to the ground or a building.

E. All lightweight signs, decals, stickers, or paint placed on vehicles, with the permission of the vehicle owner.

Numb to the Numbers: Several courts have struck down sign codes that restrict the number of political campaign signs in a person's front yard. As a result, the Institute strongly recommends against imposing quantity restrictions on temporary signs in residential areas and on other private property.

Large Signs and Lengthy Litigation: One issue that municipalities have struggled with is individuals and businesses who wish to display large protest signs on their private property regarding important political issues. These large signs are often prohibited under sign codes, leading to long and expensive lawsuits, and ultimately losses for the government. Size matters and the government can't force citizens to reduce their shouts to a whisper. The Institute strongly suggests that cities freely allow temporary signs with little or no size restrictions to allow a content-neutral avenue for citizens to adequately express themselves. Accordingly, the model sign code recommends only limiting temporary signs in residential areas.

V. Signs on public property:

Because often the most effective way to communicate with the public is by using the public right-of-way, cities and towns should allow temporary signage to be erected on public property to the extent it does not compromise public safety, such as by blocking or obscuring sightlines.

A. Temporary Signs may be erected on utility poles, traffic medians, and along roads and sidewalks subject to the following conditions:

   1. Signs must be under [*insert size*] square feet and may only be displayed for up to [*insert number of days/weeks/months*].

   2. The signs must clearly indicate the date of their posting.

      a. The signs are subject to removal without notice after their time limit has lapsed or if they otherwise fail to indicate the date of their posting.

   3. The signs are not permitted to be placed on property containing government buildings or in public parks. Nothing in this provision however, should be construed as prohibiting the government from placing its own signs on its own property.

   4. Any individual or business that has its signs removed on three separate occasions for violations of this exemption, [*insert section*], may be fined a maximum of [*insert amount*] for each subsequent sign that is illegally in the public right of way.

B. A-frame signs in commercial and industrial zones may be erected on public sidewalks without the need of first securing a sign permit, and without counting against any maximum sign allotment for the speaker, provided:

   1. A-frame signs should not exceed 4-square feet for each sign face.

   2. An establishment may display one A-frame sign on each sidewalk that it abuts.

   3. Each A-frame sign may be displayed during that establishment's hours of operation.

   4. Pursuant to [*insert section*] there is no quantity limit on A-frames erected on private property.

Autocorrect: Sign codes frequently distinguish among vehicle signs based on their purpose. For example, sign codes often ban signs on a vehicle that have a "primary purpose" of advertising a product or business—such as a parked vehicle with a "for sale" sign or advertising a nearby store—but exempt signs on vehicles that are driven for business purposes, such as a delivery car displaying a business decal. Not only are such regulations vague and difficult to apply, but distinguishing among signs by their purpose is an unconstitutional content-based distinction and should be immediately eliminated from sign codes. Sign codes should instead freely allow all one-dimensional vehicle signs.

VI. Prohibited Signs:

The following are prohibited:

A. Any sign which is structurally unsafe, unsafely installed, or otherwise hazardous to physical safety.

B. Any sign that obstructs free ingress to or egress from a fire escape, door, window, or other required access way to or from a building or site.

C. Any sign not maintained in good condition.

D. Any sign that blocks a driver's clear line of sight of traffic or pedestrians.

E. Any sign that interferes with the view of, or is confused with, any traffic control sign or device, and any sign that misleads or confuses traffic flow. A sign's position, size, shape, color, and illumination, but not its content, shall be considered when making such a determination.

F. Any sign with obscenities, as defined by federal court precedent.

G. Any sign nailed, fastened, or affixed to any tree.

H. Any sign located on private property against the wishes of the property owner.

I. Any sign that otherwise violates this sign code.

J. Enforcement against Prohibited Signs

   a. If, upon inspection, the sign inspector determines that a sign violates this section, the sign inspector should give notice to the sign owner specifically stating the nature of the violation and requiring them to repair, remove, or modify the sign within [*insert number of days*] business days after receipt of notice.

   b. In cases of emergency, meaning cases where a sign presents an imminent hazard to public safety, the sign inspector may cause the immediate removal of a dangerous or defective sign, at the owner's expense.

VII. Murals:

A. Murals may include graphics, design, or text.

B. Murals shall be allowed on any building in areas zoned as commercial or industrial with permission from the building owner.

Colorful Clashes: Cities frequently ban murals that contain text or that relate to a specific business. But such restrictions are blatantly content-based and are vulnerable to litigation. Murals should thus be allowed, regardless of content.

Kim Houghton's crime was painting a piece of art that—in the eyes of Arlington officials—was "too related" to her business.

RECEIVED
CITY OF KEIZER
MAR 29 2018
COMMUNITY DEVELOPMENT

K/SAS

Mission Statement: To enhance senior's lives with activities, classes, sociability, and meals.

Keizer/Salem Area Senior Center
930 Plymouth Drive NE
Keizer, OR 97303
Phone: 503-390-7441
ksas930@comcast.net

To: Keizer City Counsel
% Dina Russell
Community Development

From: Keizer/Salem Area Senior Center
Judi Ziebart, President Judi Ziebart

RE: Electronic Sign

Our Center is located in RM Zone so we have been limited on having an electronic sign at the corner of our property at Plymouth and Cherry NE, Keizer.

We are requesting reconsideration of your ruling. We are seniors and volunteers and standing in the rain, snow and other adverse weather conditions for 30 minutes or more is hard on our members. We would like to replace our existing sign with an electronic one that can be updated from inside the building by phone or computer. Being on the corner, traffic could read the sign but it should not disturb the residents of the apartments due to its location.

Thank you for your consideration of our request and please advise us of your decision when you have decided.

Harms, Tammie

From: Brown, Nate
Sent: Tuesday, July 10, 2018 12:20 PM
To: Harms, Tammie
Subject: FW: Proposed change to Electric Message Signs

From: Mstr.Rick [mailto:mstr.rick@comcast.net]
Sent: Friday, June 22, 2018 6:44 PM
To: Brown, Nate <brownn@keizer.org>
Subject: Proposed change to Electric Message Signs

June 6, 2018

Nate Brown
Community Development Director

City of Keizer
P.O. Box 21000
Keizer, Oregon 97307-1000

Dear Nate,

Thank you for all the information about sign codes. The new Electronic Message Signs proposals are of great interest and of some concern to me.

The frequency of change I agree should be reduced to provide time to display more messages as long as it doesn't cause an unsafe distraction to drivers. That is why I would like to suggest a frequency of at least 30 seconds and one minute would be even better. This provides time for a driver to glance back and forth to view the message safely without their eyes being off the road to long.

Thank you for taking the time to consider my proposal and please feel free to forward this to the city council for their consideration.

Sincerely,
Rick Halvorson

CITY COUNCIL MEETING: JULY 16, 2018

AGENDA ITEM NUMBER: _____

TO: MAYOR CLARK AND CITY COUNCIL MEMBERS

THROUGH: CHRISTOPHER C. EPPLEY, CITY MANAGER

FROM: TIM WOOD, FINANCE DIRECTOR

SUBJECT: AUTHORIZATION FOR SUPPLEMENTAL BUDGET – PHONE SYSTEM UPGRADE PROJECT

ISSUE:

The City of Keizer's 2017-18 Adopted Budget provided $47,000 for a phone system upgrade. The project was not able to be completed by the end of the fiscal year however it will be completed during 2018-19. In order to complete the project unused appropriations from 2017-18 need to be appropriated in 2018-19.

FISCAL IMPACT:

The budget adjustment does not have a fiscal impact it is only transferring $47,000 of unused appropriations in the Administrative Services – Finance Information Technology budget from fiscal year 2017-18 to fiscal year 2018-19.

RECOMMENDATION:

Staff recommends the City Council approve the attached resolution recognizing $47,000 in additional resources (working capital carryforward) and appropriating those resources to provide for the phone system upgrade project in the Administrative Services – Finance Information Technology budget.

CITY COUNCIL, CITY OF KEIZER, STATE OF OREGON
Resolution R2018-_____

AUTHORIZATION FOR SUPPLEMENTAL BUDGET - PHONE SYSTEM UPGRADE

WHEREAS ORS 294 provides that a supplemental budget may be adopted when an occurrence or condition which had not been ascertained at the time of the preparation of a budget for the current year which requires a change in financial planning.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Keizer, that the following appropriations be made for fiscal year ending June 30, 2019:

	Adopted/ Amended Budget	Adjustment		Revised Budget
		Increase	Decrease	
Administrative Services				
Finance - Information Systems - Expenditures	552,400	47,000		599,400
Administrative Services - Resources	552,400	47,000		599,400

To recognize additional resources and appropriate those resources to provide for the phone system upgrade project originally budgeted for 2017-18.

BE IT FURTHER RESOLVED that this resolution shall take effect immediately upon the date of its passage.

PASSED this _____ day of _____, 2018

SIGNED this _____ day of _____, 2018

_____
Mayor

_____
City Recorder

CITY COUNCIL MEETING: JULY 16, 2018

AGENDA ITEM NUMBER:_____

TO: MAYOR CLARK AND CITY COUNCIL MEMBERS

THROUGH: CHRISTOPHER C. EPPLEY, CITY MANAGER

FROM: TIM WOOD, FINANCE DIRECTOR

SUBJECT: KEIZER LITTLE LEAGUE – 2017 FINANCIAL REVIEW

BACKGROUND:

The existing park management agreement for the Keizer Little League City Park (Complex), was entered into with Keizer Little League, Inc. (KLL) on December 20, 2016 and has a term of November 1, 2016 to August 31, 2019 with the option for two additional one-year terms. The agreement requires KLL to manage, operate and maintain the Park as a public resource.

KLL is required to generate sufficient revenue to offset all costs incurred for the maintenance of the Park, with all net revenue earned and generated directly from the use of the Complex to only be used for field maintenance expense and capital improvements.

During 2016 and 2017 KLL maintained two separate bank accounts, one account for the operations of KLL and one account for the Complex. The majority of the revenue is deposited in the KLL account and transferred to the Complex account.

Specific revenues identified in the agreement to be used for field maintenance expense and capital improvements include, but are not limited to:

- Field slot payments,
- Net tournament income,
- Net field-related sponsor income, and
- Net concession income.

The agreement also requires KLL to provide financial records by July 30th of each year for the prior season. See attachment one for the summarized result of the Complex's operations for 2017, the first season covered by the agreement.

Field Slot Revenue

During 2017 the Complex received the following field slot revenue:

Keizer Little League	$ 410
KYSA, net of $1,945 in field slot refunds	5,375
Outside Users	7,242
Total Field Slots	$ 13,027

As of December 31, 2017, KLL owes the Complex $15,030 (including $1,480 related to the Iris Tournament) in field slot fees for 2017.

Net Tournament Income

During 2017, KLL hosted a tournament at the Complex and generated the following net revenue:

Iris Tournament	$ 4,000
Less Iris Tournament Expenses	2,651
Net Tournament Revenue	$ 1,349

The tournament revenue and expenses have been accounted for in the KLL records and as such represents an amount due from KLL to the Complex however after factoring in the unpaid field slot fees of $1,480 the tournament did not generate positive net revenue.

Net Concession Income

During 2017, the Park generated the following net concession income:

Concessions Revenue	$ 44,669
Less Expenses	19,084
Net Concession Income	$ 25,585

The concession revenue and income was accounted for in KLL's records and as such represents an amount due to the Complex. A partial transfer of $12,151 was made in December 2017 resulting in $13,434 still outstanding.

Summary

As of December 31, 2017, KLL owes the Complex the following for 2017 activities:

Field Slot Fee	$	15,030
Net Concession Income		13,434
Amount Due from Keizer Little League	$	28,464

Requested Contract Amendments

Net Concession Revenue - KLL has requested that the City amend the existing management agreement to allow KLL to retain one half of the net concession revenue in acknowledgement of the significant amount of volunteer hours required to operate the concession stand. Amending the contract would reduce the net concession revenue by approximately $11,000 - $12,000 annually.

During 2017, KLL estimates that they provided approximately 20,000 hours of volunteer time for complex-related work valued at $482,800 including time staffing the concession stand. Splitting the net revenue would provide financial incentive for KLL to continue to staff the concession stand for the benefit of both KLL and the Complex.

Net Tournament Revenue – KLL has requested that the City amend the existing management agreement to allow KLL to retain all of the net tournament revenue for tournaments that it hosts. Amending the contract would have a nominal financial impact on the Complex.

Tournaments are required to pay the field slot fee to cover the use of the fields, by requiring KLL to also remit the net tournament revenue they are in essence being double charged. In addition tournaments provide the benefit of the economic impact of drawing people to Keizer.

Council had tentatively approved these requests, but staff wanted to confirm any details before finalizing a contract amendment.

RECOMMENDATION:

The Council has two issues. First, how does the Council wish to deal with the shortage for 2017 as summarized above? Council can choose to require KLL to pay one, both or none of the categories referenced in the summary (field slots and net concession income). Council should also direct whether the payback should be immediate or spread over time.

Second, the City Council can choose to amend the contract for 2018 and 2019 seasons in one or more of the following ways:

1. Retain the existing contract with the Complex retaining 100% of the net concession and tournament revenue.

2. Allow KLL to keep part or all of the net concession revenue to recognize the significant volunteer hours involved in staffing the concession stand.

3. Allow KLL to keep part or all of the net tournament revenue.

Council should consider these two issues and direct staff on how to proceed.

Attachment One
Keizer Little League Park (Complex)
Statement of Activities (Cash Basis)
For the Year Ended December 31, 2017

Revenue		
Field Slots		
Keizer Little League	$	410
KYSA, net of $1,945 in field slot refunds		5,375
Outside Users		7,242
Total Field Slots	$	13,027
Field Sponsorships/Grants		
Keizer Rotary		11,820
City of Keizer Parks Matching Grant		10,000
Les Schwab - Scoreboard		4,900
Keizer Little League - Scoreboard		1,473
Total Field Sponsorship/Grants		28,193
Concessions		
Concessions Revenue		12,151
Less Expenses		2,497
Net Concession		9,653
Net Revenue		**50,873**
Expenses		
Utilities		
Electricity	$	8,656
Garbage		746
Sewer		322
Utilities		9,724
Other Expenses		
Repair, Maintenance and Supplies		1,600
Capital Expenses, (does not include $13,625 of in kind donations)		25,653
Total Other Expenses		27,253
Total Expenses		**36,977**
Net Revenue over Expenses		**13,896**
Cash in Bank as of January 1, 2017		**9,005**
Cash in Bank as of December 31, 2017	**$**	**22,901**
Amount Due from Keizer Little League as of December 31, 2017		
Field Slot Fee	$	15,030
Net Concession Income		13,434
Amount Due from Keizer Little League	$	28,464

Attachment Two
Keizer Little League
Statement of Activities (Cash Basis)
For the Year Ended December 31, 2017

	Attributable to		
	KLL	**Complex**	**Total**
Revenue			
Team Sponsors/League Sponsors			
Team/League Sponsors	$ 3,965	$ -	$ 3,965
Less Refunds	373	-	373
Net Team Sponsors/League Sponsors	$ 3,591	$ -	$ 3,591
Fundraiser			
Fundraiser Revenue	4,373	-	4,373
Less Expenses	915	-	915
Net Fundraiser Revenue	3,458	-	3,458
Registrations			
Spring Season	38,443	-	38,443
All Stars	3,559	-	3,559
Fall Ball	5,217	-	5,217
Less Refunds	(205)	-	(205)
			-
Net Registration Revenue	47,014	-	47,014
Tournaments			
Tournament Revenue	-	4,000	4,000
Less Expenses	-	2,651	2,651
Net Tournament Revenue	-	1,349	1,349
Concessions			
Concession Revenue	-	44,669	44,669
Less Concession Expenses	-	19,084	19,084
Net Concessions	-	25,585	25,585
Net Revenue	**$ 54,064**	**$ 26,934**	**$ 80,997**
Expenses			
Other Expenses			-
Administrative (insurance, charter, advertising, etc.)	17,785	-	17,785
Umpire Stipends	3,985	-	3,985
Complex Related	-	2,326	2,326
Field Slot Fees	410	-	410
			-
Total Other Expenses	**22,180**	**2,326**	24,506
			-
Uniforms			-
Spring Season	26,353	-	26,353
All Stars	10,034	-	10,034
Fall Ball	4,718	-	4,718
			-
Uniforms	41,105	-	41,105
Total Expenses	**63,286**	**2,326**	**65,612**
Net Revenue over Expenses	**(9,222)**	**24,608**	**15,386**
Transfers to Complex	-	12,151	12,151
Net Change in Cash	**(9,222)**	**12,457**	3,235
Cash as of January 1, 2017			9,950
Cash as of December 31, 2017			13,185

COUNCIL MEETING: July 16, 2018

AGENDA ITEM NUMBER: _____

TO: **MAYOR CLARK AND CITY COUNCIL MEMBERS**

FROM: **CHRIS EPPLEY**
CITY MANAGER

THROUGH: **TRACY L. DAVIS, MMC**
CITY RECORDER/COMMUNITY CENTER MANAGER

SUBJECT: **WAIVER OF COMMUNITY CENTER FEE – MID WILLAMETTE VALLEY COUNCIL OF GOVERNMENTS ANNUAL BUSINESS MEETING AND DINNER**

BACKGROUND:

The Mid-Willamette Valley Council of Governments is a voluntary association of over 40 local governments. Members include Marion, Polk, and Yamhill counties, 32 cities, 5 special districts, and the Confederated Tribes of the Grand Ronde. The City of Keizer has been a member for several years and has utilized various services and participated in regional issues. Mayor Cathy Clark currently serves on the Board of Directors. Each year, the Mid-Willamette Valley Council of Governments presents their annual report and recognizes individuals for various awards at their business meeting and dinner.

ISSUE:

This year, the Mid-Willamette Valley Council of Governments Board of Directors has chosen the Keizer Civic Center as the location for their annual business meeting and dinner. The event will be held on Wednesday, February 20, 2019 beginning at 6:00 p.m. and ending at 9:00 p.m. The Mid-Willamette Valley Council of Governments has requested a waiver of the community center room rental fees for this event. The registration fee charged for this event usually covers the cost of the meal. Other costs are covered through sponsorships or donations. Based on information provided by the Mid-Willamette Valley Council of Governments, the itemized charges for the room use on this date are listed below:

- Rental of the Iris A and Iris B rooms for 5 hours = $800 (includes 20% government discount and staffing costs)
- Refundable Security/Cleaning Deposit = $1,150
- Security (no host bar alcohol service) = $150
- Event Staff – (included in the rental rate above, however if rental rate waived, event staff would be a cost to the City for setting the room, hosting during the event, and cleaning after the event) = $180

Total rental fee would be $2,100, which $1,150 could be refundable.

Options for the City Council to consider:

1. Grant the request for a complete waiver of all fees (fees include rental fee, staffing costs, security/cleaning deposit, and alcohol security).
2. Deny the request for a complete waiver of all fees (fees include rental fee, staffing costs, security/cleaning deposit, and alcohol security).
3. Waive the room rental fee and the security/cleaning deposit but charge $180 for the staffing costs and alcohol security cost of $150 (total of $330).
4. Waive the room rental fee, security/cleaning deposit, and the staffing costs but charge for the alcohol security cost of $150.

RECOMMENDATION:

Staff recommends the City Council discuss the options presented and then direct staff accordingly.

CITY COUNCIL MEETING: July 16, 2018

AGENDA ITEM NUMBER:_____

TO: **MAYOR CLARK AND COUNCIL MEMBERS**

THROUGH: **CHRISTOPHER C. EPPLEY, CITY MANAGER**

FROM: **E. SHANNON JOHNSON, CITY ATTORNEY**

SUBJECT: **DISCHARGE OF FIREARMS – WEST SALEM QUARRY**

Last fall, firearm discharges from the quarry in West Salem unnerved and frightened people in the Sunset Park area. Last month, additional shooting sent a bullet into a home in West Keizer, landing close to the resident.

The City Council has directed staff to investigate this matter with the highest priority and to determine what type of action should be taken to preserve the safety and health of our citizens.

Though there are other avenues that we are exploring and will update you on soon, one of the best options is for the political entity with the clearest jurisdiction to take action. The Polk County Board of Commissioners could pass local legislation or take other administrative or legal actions to prohibit firearm discharges on the subject property given the history that such use is dangerous.

RECOMMENDATION:

Adopt the attached Resolution which urges the Polk County Board of Commissioners to take action legislatively and in any other manner to prohibit discharge of firearms from the West Salem quarry property.

Please contact me if you have any questions. Thank you.

ESJ/tmh

CITY COUNCIL, CITY OF KEIZER, STATE OF OREGON

Resolution R2018-_____

REQUESTING POLK COUNTY BOARD OF COMMISSIONERS TO END FIREARM DISCHARGE AND ENACT LOCAL LEGISLATION AND TAKE OTHER ACTION TO PROHIBIT THE DISCHARGE OF FIREARMS AT PROPERTY LOCATED AT OR NEAR 4000 RIVER BEND ROAD NW, SALEM, OREGON

WHEREAS, the City of Keizer is responsible for the safety and well-being of its citizens and residents;

WHEREAS, the discharge of firearms from property located in Polk County at or near 4000 River Bend Road NW, Salem, Oregon has caused property damage and future firearm discharges may raise the real risk of serious injury or death to our residents;

WHEREAS, the City Council of the City of Keizer wish to communicate to the Polk County Board of Commissioners the City Council's concern and desire to permanently cease any discharge of firearms from the subject property referenced above;

NOW, THEREFORE,

BE IT RESOLVED by the City Council of the City of Keizer that the City Council urges the Polk County Board of Commissioners to end all firearm discharge from the subject property located at or near 4000 River Bend Road NW, Salem, Oregon.

BE IT FURTHER RESOLVED by the City Council of the City of Keizer that the City urges the Polk County Board of Commissioners to act without delay to enact local

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legislation to prohibit the discharge of any firearms from the subject property and take whatever further action is appropriate and necessary to that end.

BE IT FURTHER RESOLVED that this Resolution shall take effect immediately upon the date of its passage.

PASSED this _____ day of _____, 2018.

SIGNED this _____ day of _____, 2018.

_____
Mayor

_____
City Recorder

Keizer City Attorney
930 Chemawa Road NE
PO Box 21000
Keizer, Oregon 97307
503-856-3433

MINUTES
KEIZER CITY COUNCIL
Monday, July 2, 2018
Keizer Civic Center, Council Chambers
Keizer, Oregon

CALL TO ORDER Mayor Clark called the meeting to order at 7:00 pm. Roll Call was taken as follows:

Present:	**Staff:**
Cathy Clark, Mayor	Chris Eppley, City Manager
Marlene Parsons, Councilor	Shannon Johnson, City Attorney
Kim Freeman, Councilor	Nate Brown, Community Development
Amy Ryan, Councilor	John Teague, Police Chief
Laura Reid, Councilor	Tim Wood, Finance
Bruce Anderson, Councilor	Tracy Davis, City Recorder
Roland Herrera, Councilor	

FLAG SALUTE Mayor Clark led the pledge of allegiance.

SPECIAL ORDERS OF BUSINESS None

COMMITTEE REPORTS City Manager Chris Eppley read his staff report. Councilor Freeman provided additional information.

a. Appointments to Various Committees

Councilor Parsons moved that the Keizer City Council accept the recommendations of the Volunteer Coordinating Committee: Kim Steen, position 3, Keizer Public Arts Commission; Sherrie Gottfried, position 2, Keizer Festival Advisory Board; Bob Busch and Jennifer Thomas, positions 3 and 4 respectively, Keizer Points of Interest Committee; Anne Farris; City Council Youth Councilor and Sydney Snapp, Youth Committee Liaison, Keizer Public Arts Commission. Councilor Freeman seconded. Motion passed unanimously as follows:

AYES: Clark, Reid, Freeman, Parsons, Herrera, Ryan and Anderson (7)
NAYS: None (0)
ABSTENTIONS: None (0)
ABSENT: None (0)

PUBLIC TESTIMONY *Ken Gierloff*, Keizer, representing the Southeast Keizer Neighborhood Association (SEKNA), announced the upcoming meeting and plans for National Night Out and pointed out an on-going problem related to the nuisance code. He provided details regarding the problem and asked that Council find a solution.

Community Development Director, Nate Brown, explained that some of the problems are very complex and the department does not have adequate tools to deal with chronic properties. Over 31 ordinances address the problems; staff would like to explore the development of different options that would be more streamlined and less cumbersome. He added that more effective code enforcement might require more resources. Mr. Eppley added that Ben Crosby, the Code Enforcement Officer, spends half of his time working on police issues and is very effective, but his time is limited and more resources might mean additional code enforcement staff. Chief Teague voiced support of the Code Enforcement Officer noting that he tackles and solves a lot of crime problems for the City. Mayor Clark noted that as population increases the need is greater. She urged staff to keep Council informed as to staffing required to maintain an appropriate level of service.

Darrell Richardson, Keizer, inquired as to the status of the ordinance prohibiting smoking in parks. Mayor Clark urged him to stay for the rest of the meeting when it would be addressed.

Testimony taken at end of meeting: Colleen Busch, Transit District Board, reported that the District is considering donation of a bus for use as a mobile hygiene unit in partnership with United Way and South Salem High School. The District will also continue its partnership with United Way by providing bus passes to member agencies.

PUBLIC HEARINGS

a. Keizer Development Code Text Amendment (Section 2.127 (Historic Resources) and Sections 1.200; 2.123; 2.408; 2.431; 2.432, 3.101; 3.112; and 3.202

Mayor Clark opened the Public Hearing.

Nate Brown summarized his staff report noting that this action is not in response to any specific input or direction but is simply in response to changing legislation.

Hearing no public testimony, Mayor Clark closed the Public Hearing.

Councilor Parsons moved that the Keizer City Council direct staff to prepare an ordinance with findings to adopt the proposed revisions. Councilor Freeman seconded. Motion passed unanimously as follows:

AYES: Clark, Reid, Freeman, Parsons, Herrera, Ryan and Anderson (7)
NAYS: None (0)
ABSTENTIONS: None (0)
ABSENT: None (0)

ADMINISTRATIVE ACTION

a. Keizer Little League Update

Finance Director Tim Wood explained that additional time was needed to complete the review of the Keizer Little League financial information. He noted that he expected to have a full report by the next Council meeting.

b. ORDINANCE – Establishing Keizer Parks

Shannon Johnson apologized for the delay and explained the process that brought about the changes in the Parks Regulations. He then reviewed the changes and directed attention to his staff report which

Regulations; (Repealing Ordinance No. 2010-618 and Ordinance No. 2013-679)

highlighted the changes. Lengthy discussion took place regarding reservations, violations, enforcement and fines.

Councilor Parsons moved that the Keizer City Council adopt a Bill for an Ordinance Establishing Keizer Parks Regulations; (Repealing Ordinance No. 2010-618 and Ordinance No. 2013-679). Councilor Freeman seconded. Motion passed unanimously as follows:

AYES: Clark, Reid, Freeman, Parsons, Herrera, Ryan and Anderson (7)
NAYS: None (0)
ABSTENTIONS: None (0)
ABSENT: None (0)

c. RESOLUTION – Establishing Keizer Park Use Fees; Repealing R2010-2006, R-2012-2229.1, and R2015-2619

Shannon Johnson summarized his staff report. Mayor Clark urged that the Parks Advisory Board work with the Festival Advisory Board to determine which areas should be reservable.

Councilor Parsons moved that the Keizer City Council adopt a Resolution Establishing Keizer Park Use Fees; Repealing R2010-2006, R-2012-2229.1, and R2015-2619. Councilor Freeman seconded. Motion passed unanimously as follows:

AYES: Clark, Reid, Freeman, Parsons, Herrera, Ryan and Anderson (7)
NAYS: None (0)
ABSTENTIONS: None (0)
ABSENT: None (0)

CONSENT CALENDAR

a. RESOLUTION – Authorizing the City Manager to Purchase Four Ford K8B Explorer 4WD Base Vehicles for Police Department; Repeal of R2018-2863 and R2018-2870
b. RESOLUTION – Authorizing Disposition of Surplus Property (Police Department Vehicle)
c. RESOLUTION – Authorizing City Manager to Sign Second Amendment and First Extension of City of Keizer Custodial Services Contract with Willamette Valley Rehabilitation Center, Inc.
d. RESOLUTION – Declaring the City's Intent to Initiate a Street Lighting Local Improvement District (Summerview Estates) and Directing the City Engineer to Make a Survey and File a Written Report with the City Recorder
e. Approval of June13, 2018 Work Session Minutes
f. Approval of June 13, 2018 Special Session Minutes
g. Approval of June 18, 2018 City Council Regular Session Minutes

Councilor Parsons moved for approval of the Consent Calendar. Councilor Freeman seconded. Motion passed as follows:

AYES: Clark, Reid, Freeman, Parsons, Anderson, Herrera and Ryan (7)
NAYS: None (0)
ABSTENTIONS: None (0)
ABSENT: None (0)

COUNCIL LIAISON REPORTS

Councilor Anderson announced the upcoming Chamber Board and Stormwater Advisory Committee meetings.

Councilor Herrera thanked those who covered for him while he was incapacitated and announced that he would be attending the Peoples' Representative Council in Woodburn on July 21. He also announced that former City Manager Wally Mull passed away this past week and expressed condolences to his family.

Councilor Parsons announced the upcoming Volcanoes game, cancellation of the Marion County Commissioners Breakfast and the Traffic Safety/Bikeways/Pedestrian Committee meeting.

Councilor Reid reported on the Keizer Heritage Foundation meeting and the community dinner, and announced the upcoming Southeast Keizer Neighborhood Association (SEKNA) meeting and Shakespeare in the Park.

Councilor Freeman announced upcoming Planning Commission and Stormwater Advisory Committee meetings. She urged everyone to be careful while driving, watch for pedestrians and cyclists, and not to leave anyone in cars during the summer heat.

Councilor Ryan announced the summer concert series at Keizer Rapids Park and congratulated the Beavers.

Mayor Clark reviewed meetings/events she had attended including the Council of Governments, the Women in Construction dinner, the stick pickup at Keizer Rapids Park, and Salem-Keizer Area Transit Study meeting. She also announced Keizer Rotary Amphitheater concerts, the Marion County Fair, and the League of Oregon Cities Conference.

OTHER BUSINESS

Chief Teague announced that 4 of 5 officers hired are graduating next Friday. National Night Out is the first Tuesday in August. Information is available on the website.

WRITTEN COMMUNICATIONS

Mayor Clark read a letter from the Willamette Falls Locks Commission inviting people to a meeting July 18.

AGENDA INPUT

July 9, 2018: 5:45 p.m. – City Council Work Session

July 16, 2018: 7:00 p.m. City Council Regular Session

August 6, 2018: 7:00 p.m. City Council Regular Session

ADJOURNMENT

Mayor Clark adjourned the meeting at 8:22 p.m.

MAYOR: APPROVED:

Cathy Clark

Debbie Lockhart, Deputy City Recorder

COUNCIL MEMBERS

Councilor #1 – Laura Reid	Councilor #4 – Roland Herrera
Councilor #2 – Kim Freeman	Councilor #5 – Amy Ryan
Councilor #3 – Marlene Parsons	Councilor #6 – Bruce Anderson

Minutes approved:_____

Written Communications/Testimony and Submitted Documents

COUNCIL MEETING: July 16, 2018

AGENDA ITEM NUMBER: _____

TO: **MAYOR CLARK AND CITY COUNCIL MEMBERS**

FROM: **CHRIS EPPLEY**
CITY MANAGER

THROUGH: **TRACY L. DAVIS, MMC**
CITY RECORDER/COMMUNITY CENTER MANAGER

SUBJECT: **WAIVER OF COMMUNITY CENTER FEE – CELEBRATION OF LIFE FOR WALLY MULL**

ISSUE:

The family of Wally Mull, former Keizer Water District and City of Keizer employee from 1969 to 2000, is planning a Celebration of Life for Wally Mull on Friday, August 3, 2018 at the Keizer Community Center. Mr. Mull passed away on June 26th at his home in Las Vegas, Nevada. The family has asked the City Manager to consider waiving the Community Center rental fee, deposit, security fee, and general liability insurance requirement for this celebration. The event will be held from 5:00 p.m. to 7:00 p.m. and the estimated attendance is 150 people.

Keizer Resolution R2015-2612 – Adopting Use Policies and Rates for the Keizer Community Center Rooms – includes a list uses exempt from payment of use rates, however none of the exemptions provide the City Manager the ability to waive the use fee for an event of this type.

Based on information provided by Mr. Mull's family, the itemized charges for the room use is listed below:

- Rental of the Iris A and Iris B rooms for 4 hours (initial access 1 hour prior to start of event and exit 1 hour after the end of the event) = $800 (includes staffing costs)
- Refundable Security/Cleaning Deposit = $1,150
- Security (no host bar alcohol service) = $50
- Event Staff – (included in the rental rate above, however if rental rate waived, outside event host staffing would not be necessary as there are community center employees willing to assist).

Total rental fee would be $2,000, which $1,150 could be refundable.

In addition to the room fee waiver, the family has also requested a waiver of the required comprehensive general liability insurance policy in the amount of $1,000,000. The policy which would name the City of Keizer as an additional insured, would cost the family approximately $150 to purchase for this event. The alcohol service for this event is being

provided by one of the City's approved vendors, who carries the liquor liability insurance for serving alcohol.

Options for the City Council to consider:

1. Grant the request for a complete waiver of all fees (fees include rental fee, staffing costs, security/cleaning deposit, and alcohol security) plus a waiver of the general liability insurance policy requirement.
2. Deny the request for a complete waiver of all fees (fees include rental fee, staffing costs, security/cleaning deposit, and alcohol security) plus a waiver of the general liability insurance policy requirement.
3. Waive the room rental fee (including staffing costs), security/cleaning deposit, and the general liability insurance policy requirement but charge alcohol security cost of $50.
4. Waive the room rental fee, security/cleaning deposit (including staffing costs) but charge for the alcohol security costs of $50 and require the general liability insurance policy.
5. Waive the room rental fee, security/cleaning deposit (including staffing costs), waive the charge for the alcohol security costs, but require the general liability insurance policy.

RECOMMENDATION:

Staff recommends the City Council discuss the options presented and then direct staff accordingly.

CITY COUNCIL, CITY OF KEIZER, STATE OF OREGON

Resolution R2015-2612

ADOPTING USE POLICIES AND RATES FOR THE KEIZER COMMUNITY CENTER ROOMS; **REPEALING RESOLUTIONS R90-495, R2006-1699, R2009-1937, AND R2011-2131**

WHEREAS, the City Council adopted policies for community use of city hall facilities in 1986;

WHEREAS, the adopted policies for community use of city hall facilities has been amended several times with the last revision taking place in 2009 when the new city hall facilities became available;

WHEREAS, the City Council adopted the current use rates for the Civic Center Community Rooms pursuant to Resolution R2011-2131;

WHEREAS, the City Council has reviewed the matter and finds that it is appropriate to combine the policies and the use rates for the Community Center Rooms;

WHEREAS, the City Council desires to amend the use rates;

NOW, THEREFORE,

BE IT RESOLVED by the City Council of the City of Keizer that the following policies for use of the Keizer Community Center Rooms and lobby are hereby adopted:

Alcohol Policies: The following regulations apply to the allowance, sale or consumption of alcoholic beverages in the Keizer Community Center Rooms and lobby:

a. Only individuals twenty-one (21) years of age or older may consume alcohol in accordance with this policy.

b. No person shall sell, give or otherwise make available any alcoholic beverage to a person under the age of 21 years.

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E-Stored

c. No person shall sell, give or otherwise make available any alcoholic beverage to any person who is visibly intoxicated.

d. Alcoholic beverages are permitted only in the Community Rooms and the adjoining lobby areas. Alcoholic beverages are prohibited outdoors and in other areas of the building.

e. Alcoholic beverages are allowed only in conjunction with a reserved event and only after written approval has been given by the City or an authorized agent of the City.

f. Alcoholic beverages will be served only by a licensed and bonded server pursuant to all Oregon Liquor Control Commission laws and regulations.

g. The applicant for the event shall provide certificate of insurance insuring the City, its employees, agents and contractors against liability in an amount to be determined by the City Manager. As part of the event reservation process, the applicant shall agree to defend, indemnify and hold the City, its employees, agents and contractors from any and all claims in connection with alcohol use on the premises.

h. The City Manager may place reasonable conditions on the event to protect persons and property.

BE IT FURTHER RESOLVED by the City Council of the City of Keizer that the following use rates are hereby established:

1. Base Use Rates. The following base use rates shall be charged for the Keizer Community Center Rooms:

a. Small room (1,000 square feet) - $25.00 per hour with a three hour minimum.

b. Medium room (3,000 square feet) - $100.00 per hour with a four hour minimum.

c. Large ballroom (9,000 square feet) - $250.00 per hour with an eight hour minimum.

d. Tax-exempt, Keizer-based 501(c)(3) organizations may host fundraiser activities using two Medium rooms or the Large ballroom for a base use fee of $500.00. This fee shall include the use of the facility and amenities. The user will be responsible to pay all fees associated with required staffing. The use under this provision is limited to one (1) event per calendar year per Keizer-based 501(c)(3) organization and is limited to a maximum of twelve (12) hours usage.

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e. Keizer residents and Keizer-based 501(c)(3) non-profit organizations are entitled to a twenty-five percent (25%) discount on the base use rates outlined in 1(b) and 1(c) herein. (Small rooms are not discounted. Keizer residents' use is limited to personal, non-business use only, including, but not limited to birthday parties, anniversary parties, and baby showers.)

f. Government partners, e.g., City of Salem, Marion County, State of Oregon, Keizer Fire District, Salem-Keizer Transit District, Keizer Chamber of Commerce, League of Oregon Cities, Mid-Willamette Valley Council of Governments, are entitled to a twenty percent (20%) discount on the base use rates outlined in 1(b) and 1(c) herein. (Small rooms are not discounted.)

2. Exempt Uses. The following uses are exempt from payment of use rates:

a. City Meetings. City Council/Urban Renewal Agency meetings, formal City/Urban Renewal Agency committee, task force, or staff meetings;

b. Neighborhood Associations. Recognized neighborhood associations may hold their regular meetings, up to twelve (12) meetings per year.

c. Keizer-based Youth Sports Registrations. Keizer-based youth sports organizations may hold up to three (3) registration (sign-ups) events per year.

d. Town Hall/Community Forums. City, Urban Renewal Agency, Salem Area Mass Transit District, Marion County, and other governmental agencies may hold town hall/community forums for the purpose of gathering public input.

3. Other Agreements Exempt. Organizations with specific agreements for Community Room use are exempt from the above rates.

4. Additional Facility Charges. In addition to the base use rates, the City Manager is also authorized to adopt and impose surcharges for rental rates for additional facilities, including, but not limited to stages, audio/visual equipment, computer equipment, kitchen usage and additional labor expenses. The City Manager is authorized to impose deposits, fees or additional charges as City Manager may deem appropriate in his/her discretion.

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5. Use Rates Subject to Facility Agreement. The use rates set forth herein are subject to the provisions of the Facility Use Agreement as authorized by the City Manager. The City Manager is authorized to amend the use rates if in the City Manager's discretion such amended rates provide increased transient occupancy taxes, other identifiable economic benefits to the citizens of the City as a whole, or other identifiable fiscal benefits to the City of Keizer administratively.

BE IT FURTHER RESOLVED by the City Council of the City of Keizer that Resolution R90-495 (Amending Resolution R86-229 Establishing a Policy for Community Use of City Hall Facilities), Resolution R2006-1699 (Policy for Community Use of City Hall Facilities), Resolution R2009-1937 (Amending Policy for Community Use of City Hall Facilities), and Resolution R2011-2131 (Adopting Use Rates for the Civic Center Community Rooms) are hereby repealed in their entirety.

BE IT FURTHER RESOLVED that this Resolution shall take effect immediately upon the date of its passage.

PASSED this 17th day of August, 2015.

SIGNED this 19th day of August, 2015.

Cathy Clark
Mayor

City Recorder

Keizer City Attorney
930 Chemawa Road NE
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Keizer, Oregon 97307
503-856-3433

Davis, Tracy

From:	GARRY WHALEN <garryw.1@comcast.net>
Sent:	Sunday, July 15, 2018 4:57 PM
To:	Cathy Clark
Cc:	Laura Reid; Kim Freeman; Marlene Parsons; Roland Herrera; Amy Ryan; Bruce Anderson
Subject:	Celebration of Life for Wally Mull

Dear Mayor and Councilors,

It is my understanding that you will be asked to waive the cost and insurance fees for former City Manager Wally Mull's celebration of life scheduled for Aug 3,2018. This email is to voice support for this and encourage all of you to do likewise. Additional support for this comes from an understanding of Wally's many contributions to this community, many predating the incorporation of Keizer.

20 years as a volunteer with Keizer Fire Dist.

Many years coaching and officiating Babe Ruth Baseball, Keizer Little League softball and KYL basketball. In this role he had a positive and encouraging role in literally hundreds of young lives.

Approximately 16 yrs. as an employee of the Keizer Water Dist. Starting as an employee installing water lines and meters he grew to a management level employee.

When the Water Dist. was absorbed into the City in 1985 Wally was the water superintendent. Shortly there after he became Public Works Director ultimately serving as City Manager until his retirement in 2000.

His Family has once again chosen to share Wally with our community by returning for a Celebration of his life. It seems only appropriate that the City waive the cost of the meeting room and general liability insurance for this man who contributed over 31 years in service to our community. Thank you for your consideration and expected support on this matter. Please do the right thing and say "yes" to this request.

Sincerely,

Garry Whalen

Davis, Tracy

From: rhondarich9@aol.com
Sent: Monday, July 16, 2018 10:50 AM
To: Davis, Tracy
Cc: Elvin McCann
Subject: Fwd: Letter to the Council

Hello Traci,

I am forwarding this email that I received from a neighbor.

Please enter it into written testimony.

Will it be read at tonight's meeting?

Thank you,

Rhonda Rich

Marlene
Please read under written communications.
Thanks!

-----Original Message-----
From: Al McCann <al.mccann@sbcglobal.net>
To: Rhonda Rich <Rhondarich9@aol.com>
Sent: Mon, Jul 16, 2018 7:34 am
Subject: Letter to the Council

Dear City Council,

Carole and I have lived along the river in Keizer since 1991. We feel the tension of possibly being hit or specially our grandchildren being hit by stray or ricocheting bullets being fired from across the river. It is especially discouraging knowing what I know now as the result of this latest incident, that if my granddaughter were to be stuck and killed by a bullet that it would be considered an accident and the Polk County District Attorney would drop the charges anyway because he could not prove which of the many persons shooting actually fired that particular round.
I think it's important that everyone in the city realize that their families are at risk, not just those who live on the river bank. Bullets are being fired up in the air by the hundreds sometimes from automatic weapons and they can travel up to three miles coming down and striking random locations. The shooting is not always limited to daytime hours either.
I think everyone in the city should be made aware that the danger exists at their homes and that they may want to look around or think back to see if they have been a victim.
I am a rifle owner and hunter but I would never consider hunting or especially shooting in the neighborhood where I could put my neighbors, friends and family at risk.
I think that just because it's used by police and fire officers is not a good excuse to allow this neighborhood shooting to continue. They need to seek or build an indoor range, the only truly safe place to shoot this close to the city.
Thank you for listening,
Al and Carole McCann