City of Las Cruces®

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Council Action and Executive Summary

Item # 2 **Ordinance/Resolution#** 10-144 **Council District:** 6

For Meeting of November 23, 2009
(Adoption Date)

TITLE: A RESOLUTION TO APPEAL THE DENIAL DECISION OF THE PLANNING AND ZONING COMMISSION ON A REQUEST FOR A THIRTEEN (13) FOOT VARIANCE FROM THE MAXIMUM ALLOWED HEIGHT OF SEVEN (7) FEET AND A REQUEST FOR A SIXTY-FOUR (64) SQUARE FOOT VARIANCE FROM THE MAXIMUM ALLOWED SIZE OF FORTY (40) SQUARE FEET OF A FREESTANDING SIGN FOR PROPERTY LOCATED AT 115 ROADRUNNER PARKWAY. SUBMITTED BY CARRIE SWARTZ, SWARTZ INVESTMENT GROUP LLC, ON BEHALF OF GARY ANDERSON, PROPERTY OWNER (A1701).

PURPOSE(S) OF ACTION: Reversal of a denial decision made by the Planning and Zoning Commission on September 22, 2009 for a variance to permit a taller and larger freestanding sign.

Name of Drafter: Adam Ochoa AO		Department: Community Development		Phone: 528-3204	
Department	**Signature**	**Phone**	**Department**	**Signature**	**Phone**
Community Development	[signature]	528-3066	Budget	[signature]	541-2107
			Assistant City Manager	[signature]	541-2271
Legal	[signature]	541-2128	City Manager	[signature]	541-2076

BACKGROUND / KEY ISSUES / CONTRIBUTING FACTORS:

The applicant, Carrie Swartz, is requesting a variance of thirteen (13) feet from the maximum allowed height of seven (7) feet and a variance of sixty-four (64) square feet from the maximum allowed size of forty (40) square feet for a freestanding sign. The applicant would like to install a twenty (20) foot tall freestanding illuminated sign with a total size of 104 square feet. The subject property is located at 115 Roadrunner Parkway, encompassing 1.72 +/- acres, and is the current location of a business/shopping center.

The subject property is located within the Sombra de Colores Subdivision in an area of the subdivision where lots are zoned C-3C (Commercial High Intensity – Conditional). One of the conditions placed on the zoning of these lots is that the development is subject to the Lohman Avenue Overlay District guidelines found in the 2001 Zoning Code, as amended. This was done due to the fact that the subdivision is located directly adjacent to the Lohman Avenue Overlay District and an overall coherent urban design was desired in this area of the City.

Article 5, Section 38-47B of the 2001 Zoning Code, as amended, states that in the Lohman Avenue Overlay District freestanding signage will be limited to monument/ground signs for properties located east of Nacho Road. Monument/ground signs in this area shall have a maximum height of seven (7) feet and consist of a maximum of forty (40) square feet in area.

All freestanding signs located west of Nacho Road are required to simply comply with the City of Las Cruces Sign Code, Chapter 36 of the Las Cruces Municipal Code, as amended.

The applicant has stated that the sign will be used to help identify the businesses in the shopping center that cannot be easily seen from the street. The applicant also stated that the property has a dramatic grade change, physical barriers, an abnormal terrain, and road and building obstacles that inhibit some of the businesses on the property from being seen by potential customers. The applicant goes on to state that an elevated pole sign will be much more easily noticed from the street than any type of attached signage placed on the walls of the buildings that are very difficult to see from the street. The applicant has also stated that utility service boxes on the property would block a ground sign from being seen properly from all directions. The proposed sign would be placed on the property where it can easily be viewed from all directions of the street. The applicant concludes by stating that the proposed new sign will be installed a minimum of five (5) feet away from the front property line in the landscaped area of the subject property and that the sign will have a textured stucco skirting around the support pole that will match the buildings on the property.

On September 22, 2009 the Planning & Zoning Commission (P&Z) denied the variance request for Case A1701 by a vote of 2-3 (one commissioner absent). Staff recommended denial to the P&Z for the variance request based on the absence of a hardship on the property.

During the P&Z meeting much discussion occurred between the P&Z and the applicant. Issues discussed at the meeting pertained to the proposed location of the larger sign, the reason why the applicant's area on the sign was the size it was, the possibility of moving the proposed sign either to the southeast or northeast corner of the subject property, and the reason why the sign could not follow Zoning Code provisions and just be placed on a much more visible location on the subject property like at the southeast or northeast corner along Roadrunner Parkway. The reasons stated by P&Z to deny the request included staff findings of no physical hardship and general discussion at the public hearing. The evaluation criteria utilized by P&Z regarding variances is located within Article II Section. 38-10 J/Criteria for Decisions:

- A physical hardship relative to the property (i.e. topographic constraints or right-of-way takes resulting in reduced development flexibility, etc.) in question.

- The potential for spurring economic development at a neighborhood or city-wide level if requested allowances are granted.

- Monetary considerations, not as a whole, but relative to options available to meet the applicant's stated objectives when such options cause considerable monetary hardship under strict application of code provisions.

On October 5, 2009 the applicant filed the appeal of the P&Z decision with the Community Development Department.

SUPPORT INFORMATION:

Fund Name / Account Number	Amount of Expenditure	Budget Amount
N/A	N/A	N/A

1. Resolution
2. Exhibit “A” - Property description
3. Attachment “A” - Basis of appeal & supporting documents
4. Attachment “B” - Staff Report to the Planning and Zoning Commission for Case A1701
5. Attachment “C” - Draft minutes from the September 22, 2009 Planning and Zoning Commission
6. Attachment “D” - Vicinity Map

OPTIONS / ALTERNATIVES:

1. Vote YES to approve the Resolution. This action reverses the Planning and Zoning Commission decision and grants the applicant a thirteen (13) foot variance from the maximum allowed height of seven (7) feet and a sixty-four (64) square foot variance from the maximum allowed size of forty (40) square feet for a freestanding sign for the property located at 115 Roadrunner Parkway.

2. Vote NO to deny the Resolution. This action upholds the decision made by the Planning and Zoning Commission. The applicant will be required to adhere to a maximum height of seven (7) feet and a maximum of forty (40) square feet for a freestanding sign.

3. Modify the Resolution and vote YES to approve the modified Resolution. The Council may modify the Resolution by adding conditions as deemed appropriate. This can be accomplished by staff submitting a substitute Resolution.

4. Table/Postpone the Resolution and direct staff accordingly.

RESOLUTION NO. 10-144

A RESOLUTION TO APPEAL THE DENIAL DECISION OF THE PLANNING AND ZONING COMMISSION ON A REQUEST FOR A THIRTEEN (13) FOOT VARIANCE FROM THE MAXIMUM ALLOWED HEIGHT OF SEVEN (7) FEET AND A REQUEST FOR A SIXTY-FOUR (64) SQUARE FOOT VARIANCE FROM THE MAXIMUM ALLOWED SIZE OF FORTY (40) SQUARE FEET OF A FREESTANDING SIGN FOR PROPERTY LOCATED AT 115 ROADRUNNER PARKWAY. SUBMITTED BY CARRIE SWARTZ, SWARTZ INVESTMENT GROUP LLC, ON BEHALF OF GARY ANDERSON, PROPERTY OWNER (A1701).

The City Council is informed that:

WHEREAS, Gary Anderson, the property owner of 115 Roadrunner Parkway, has submitted the following variance request:

a) A 13-foot variance from the maximum allowed height of 7-feet and a 64-square foot variance from the maximum allowed size of 40-square feet for a freestanding sign for property located at 115 Roadrunner Parkway; and

WHEREAS, the Planning and Zoning Commission, after conducting a public hearing on September 22, 2009, denied said variance request by a vote of 2-3 (one Commissioner absent).

NOW, THEREFORE, Be it resolved by the governing body of the City of Las Cruces:

(I)

THAT the denial decision by the Planning and Zoning Commission is hereby reversed.

(II)

THAT granting this variance is in accordance with Section 38-10, Criteria for Decisions, of the Las Cruces 2001 Zoning Code, as amended.

(III)

THAT the property owner is hereby granted the following variance for the property located at 115 Roadrunner Parkway: A 13-foot variance from the maximum allowed height of 7-feet and a 64-square foot variance from the maximum allowed size of 40-square feet to allow a 20-foot tall freestanding sign with a total size of 104-square feet in area as illustrated on Exhibit "A" attached hereto and made part of this Resolution.

(IV)

THAT City staff is hereby authorized to do all deeds necessary in the accomplishment of the herein above.

DONE AND APPROVED this_____ day of _______________ 2009.

APPROVED:

(SEAL)

____
Mayor

ATTEST:

____

City Clerk

VOTE:

Mayor Miyagishima	_____
Councillor Silva	_____
Councillor Connor	_____
Councillor Pedroza	_____
Councillor Small	_____
Councillor Sorg	_____
Councillor Thomas	_____

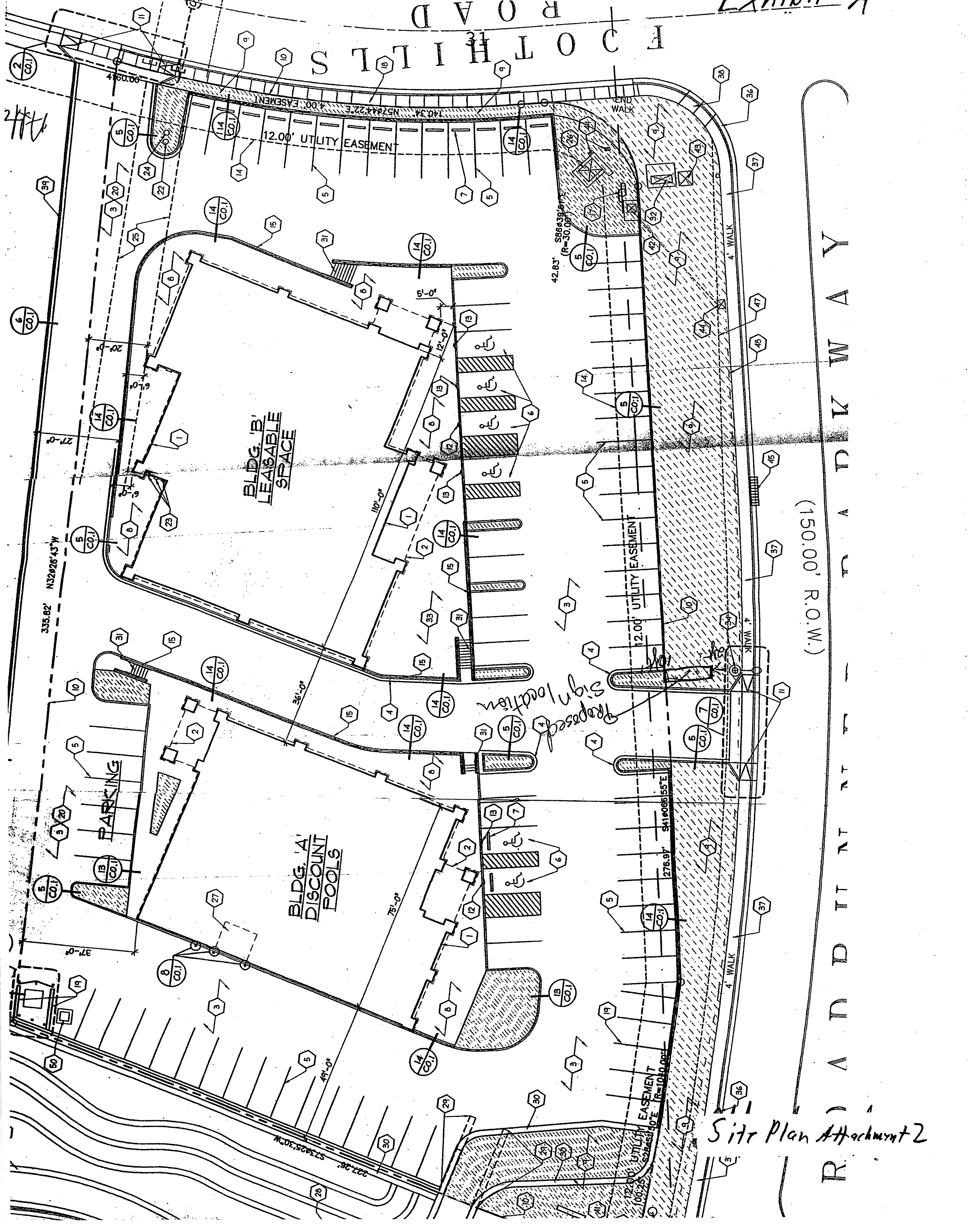
Moved by: ____________________

Seconded by: ________________

APPROVED AS TO FORM:

____
City Attorney

Exhibit "A"



Site Plan Attachment 2

Attachmnt "A"

Carrie Swartz
Swartz Investment Group;
DBA: Fox's Pizza Den
P.O. 717
Dona Ana, NM, 88032

Las Cruces City Council
200 N. Church St.
Las Cruces, NM 88001

RE Appeal Request for **Case A1701:** (A request for a variance from the type of freestanding signage allowed in the Lohman Avenue Overlay District (LAO)

Dear Las Cruces City Council Members;

I am submitting my appeal to the Las Cruces City Council concerning the denial by the Planning and Zoning commission on case **# A1701:** (A request for a variance from the type of freestanding signage allowed in the Lohman Avenue Overlay District (LAO). Submitted by Carrie Swartz, Swartz Investment Group LLC on behalf of and with support of property owner Gary Anderson and other future and existing tenants.

The property in question is located at 111 & 115 Roadrunner Parkway, Las Cruces, NM. It lies on the northern edge of the LAO and is east of Nacho road. East of Nacho road in the LAO a ground monument sign is the only type of freestanding sign allowed with a maximum height of seven (7) feet and a maximum signage size of forty (40) square feet. This does not matter whether it is one business on a property or 50, nor does it account for the property size. Furthermore this property is zoned C-3C (Commercial High Intensity–Conditional).

This particular property in question has overwhelming physical barriers not found in combination elsewhere in the LAO:

1. The dramatic grade of Roadrunner Parkway north from the Lohman intersection to the Foothills intersection . (Attachment A) There is a 30 ft drop along the property frontage on Roadrunner which equates to more than a 10% grad. That's a drop of 1 foot for 10 linear feet. The dramatic grade combined with the property size and shape lead to the two buildings being placed behind various retaining walls in a huge hole lower than the existing road.
2. The dramatic road curve from the Roadrunner Lohman intersection north to the Foothills Roadrunner intersection (Attachment B). The road curves approximately 45 degrees directly

in front of the property (almost midway). Furthermore the northbound traffic entering Roadrunner from the Lohman intersection is traveling in a North easterly direction visually and physically away from the property until the last approximate 30 feet – which is past the hidden interior businesses.

3. The depression and angle of the two buildings on the property to the Road (Attachment A & B). The parking lot and buildings are 5- 15 feet lower than the immediate southbound traffic lane and behind a retaining wall.. Further because of the size and shape of the property the buildings were placed at an acute angle away from the southbound traffic. This orientation inhibits both north and south bound traffic normal driving field of vision restricting visibility and identification of the inner businesses in either direction.

4. Extended Clear Site triangles secondary to the above road conditions. The clear site triangles are larger than standard because of the above mentioned road conditions which combined with utility easements dramatically limit available signage location and visibility. Signage under current code restrictions would be ineffective at relieving the current physical hardships.

When I first came before the Planning and Zoning commissioners in April 2009 I was requesting an elevated pole sign with the support of the property owner. The commissioners were concerned that the other businesses in the plaza were not being represented on the sign request which might cause them to come forth requesting another sign variance at a latter date. Another concern of the commissioners was that the property owner was not present at the April meeting. Thus the Planning and Zoning commissioners requested I return with a completed sign design and the property owner to a future meeting. I, with the support of the property owner, finalized a request for a variance to install a 20 foot tall elevated monument style sign(attachment C) with a total size of 104 square feet of signage space and was denied (3 to 2) a variance at the Planning and Zoning meeting September 22, 2009.

It is obvious the physical barriers present at 111/115 Roadrunner are significant. The current multi tenant building (115) has lost 3 of the 5 original businesses. One has been leased but the other two spaces have been empty for over a year. The demise of these businesses is related to many factors but also due to the visibility of this building. It is a nice location but terrible visibility. Even with a high profile item as pizza most people who pass by this location still do not know it is there. There are even many patrons of the corner Fitness establishment who do not know Fox's Pizza is a few doors down.

The sign design presented will be used for the purpose of identification of the hidden businesses within this property by traffic traveling north and south along Roadrunner Parkway but also allows for the addition of the two visible businesses (Discount Pools and Anytime Fitness) if needed at a latter date. The sign would be built in two stages. The first stage I am financing (attachment C1 &2). The second stage will be the responsibility of the other tenants or the property owner when they can but they will have to follow the design we have approved.

The requested variance and sign design is the minimum necessary to provide relief from the physical barriers based on interpretation of the Transportation Research Board Journal Article "Model Guidelines for Visibility of On-Premise Advertisement Signs" (attachment D); United States Sign Council(USSC) "On Premise Signs Guideline & Standards (attachment E); USSC "Determination of Parallel Sign Legibility and Letter Height" (attachment F); USSC " Sign Legibility Rules of Thumb"(Attachment G); field data of area signs; and various letter visibility charts . A monument ground sign would not be seen by the North bound traffic at all because of the previous mentioned physical barriers and the southbound traffic would have limited time for recognition because of individual business sign size and depending on traffic lane. Furthermore, a monument ground sign would have very limited placement on the property because of the extended clear site triangles due to the road curve and grade. Clear site triangles require nothing greater than 1 foot wide between 3 and 8 feet high. Even if a monument sign could be placed somewhere between the entrance to the property and Foothills outside of the clear site triangles it still has a big potential to cause an unsafe condition for the traffic coming from Foothills onto Northbound Roadrunner by blocking extended viewing of the Roadrunner Northbound traffic around the sharp curve. By elevating the sign to the minimum 8 ft required by the clear site triangle, the sign will have reasonable and safe visibility by North and South bound Roadrunner traffic and by traffic at the Foothills Roadrunner intersection.

The request for increased sign space to 104 feet is again based on reasonable visibility identification. Limiting the signage space to the current 40 sq ft would be ineffective due to the distance from the property curb to north bound traffic is over 50 feet perpendicular and the viewing angle of North bound traffic is greater than 90 degrees. Combine this with dividing 40 sq ft between 6 businesses, the length of time and distance for letter legibility would dramatically decrease well below the recommended Decision sight distance of 5.5s by the Transportation Research Board (page 84 of attachment D) which is less than the recommended time by the USSC. The Decision Sight Distance is the amount of time necessary for legible identification (5 or less elements/ partitions/ signs) , mental processing and the reaction of a driver. In addition to decreased legibility because of multiple businesses when elevating a sign there is a need to increase the sign size for legibility to offset the height (increased viewing distance). The requested

104sq feet sign would allow reasonable safe sized letters which would increase the Decision sight distance to an appropriate time based on the additional abnormal road conditions and abnormal driving view angle of the north bound traffic. The increased size and elevation of the sign placed at the properties entrance to Roadrunner, allows drivers legible identification, adequate reaction time and distance to turn west on to Foothills (north or south bound traffic) without creating an unsafe situation

The requested sign will not deter from the Lohman Overlay District goal to "promote an attractive image for the city as a whole". There are two properties on the west side of Roadrunner from Lohman to Foothills. The Lohman Roadrunner corner property (AAA and Citizens Bank) has its signs right at the intersection. The property in question has about 1/2 the road frontage (277 ft) and thus this sign would appear to be the only sign on the whole block. It will have the appearance of an elevated monument sign similar to the Old Navy sign on Lohman (attachment C3 & H) but on a smaller scale. The total height of the sign will most likely be 24 - 25 ft tall because of the extended clear site triangles due to the angle of the property (nothing between 3-8 feet) and because of the additional monumental aesthetic design. But despite this elevation it would appear from the Lohman Roadrunner intersection and most of the initial North bound traffic to appear to be at ground level or slightly above.

I request the council review all these facts and make a site appraisal before issuing a judgment on my appeal.

Thank you.

Carrie J. Swartz

Attachments

A – PHOTO: GRADE AND CURVATURE OF ROAD;
DEPRESSION AND ANGLE OF PROPERTY AND BUILDINGS

B –PHOTO 1 -3 : CURVATURE OF ROAD;
DEPRESSION AND ANGLE OF PROPERTY AND BUILDINGS
DRIVER LINE OF SITE

C – Drawings 1 & 2.; Sign Design;
3 Photo: Old Navy Sign

D – TRB: "Model Guidelines for Visibility of On-Premise Advertisement Signs"

E - United States Sign Council(USSC) "On Premise Signs Guideline & Standards

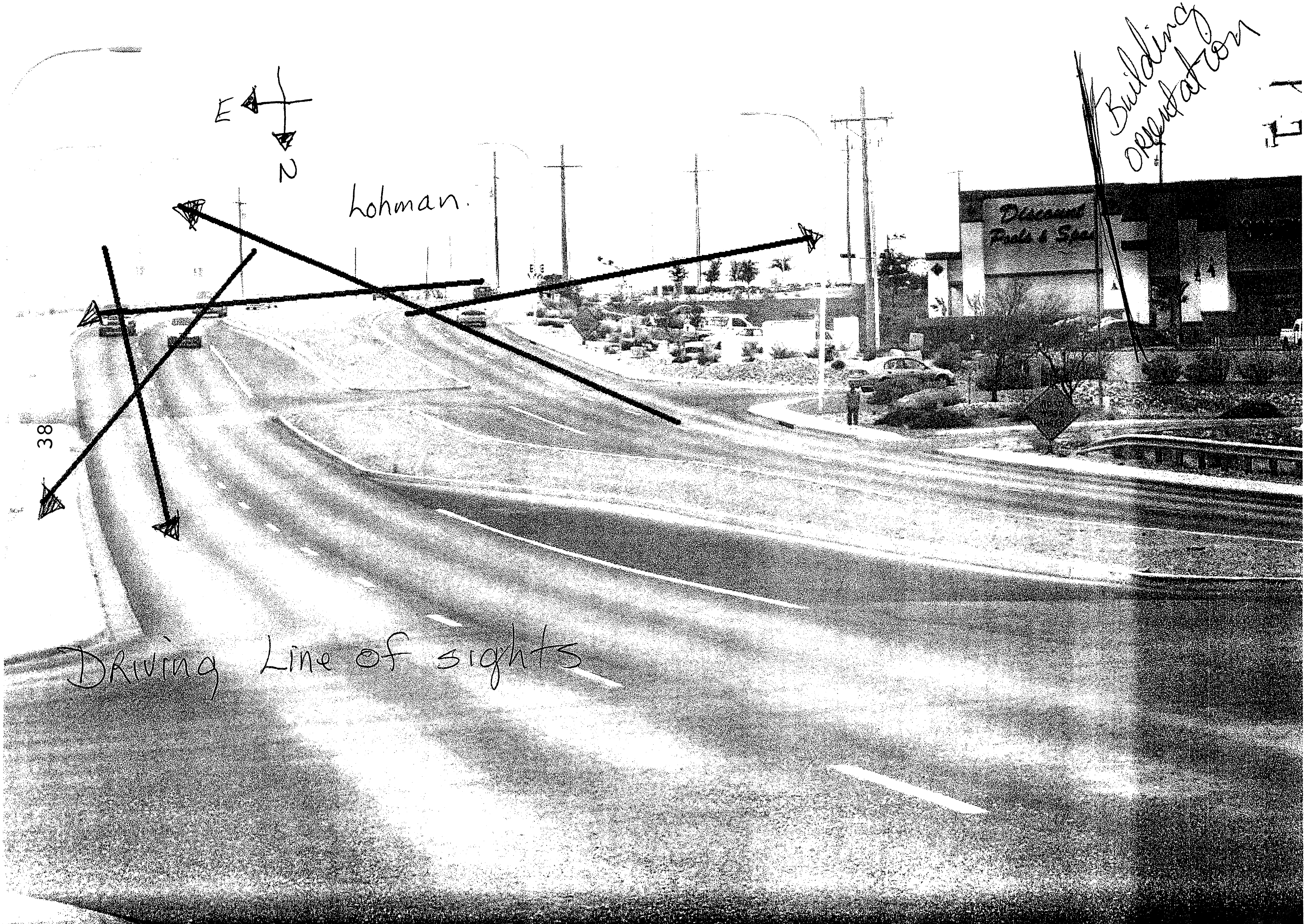
F. – (USSC); " Determination of Parallel Sign Legibility and Letter Height"

G – USSC " Sign Legibility Rules of Thumb"

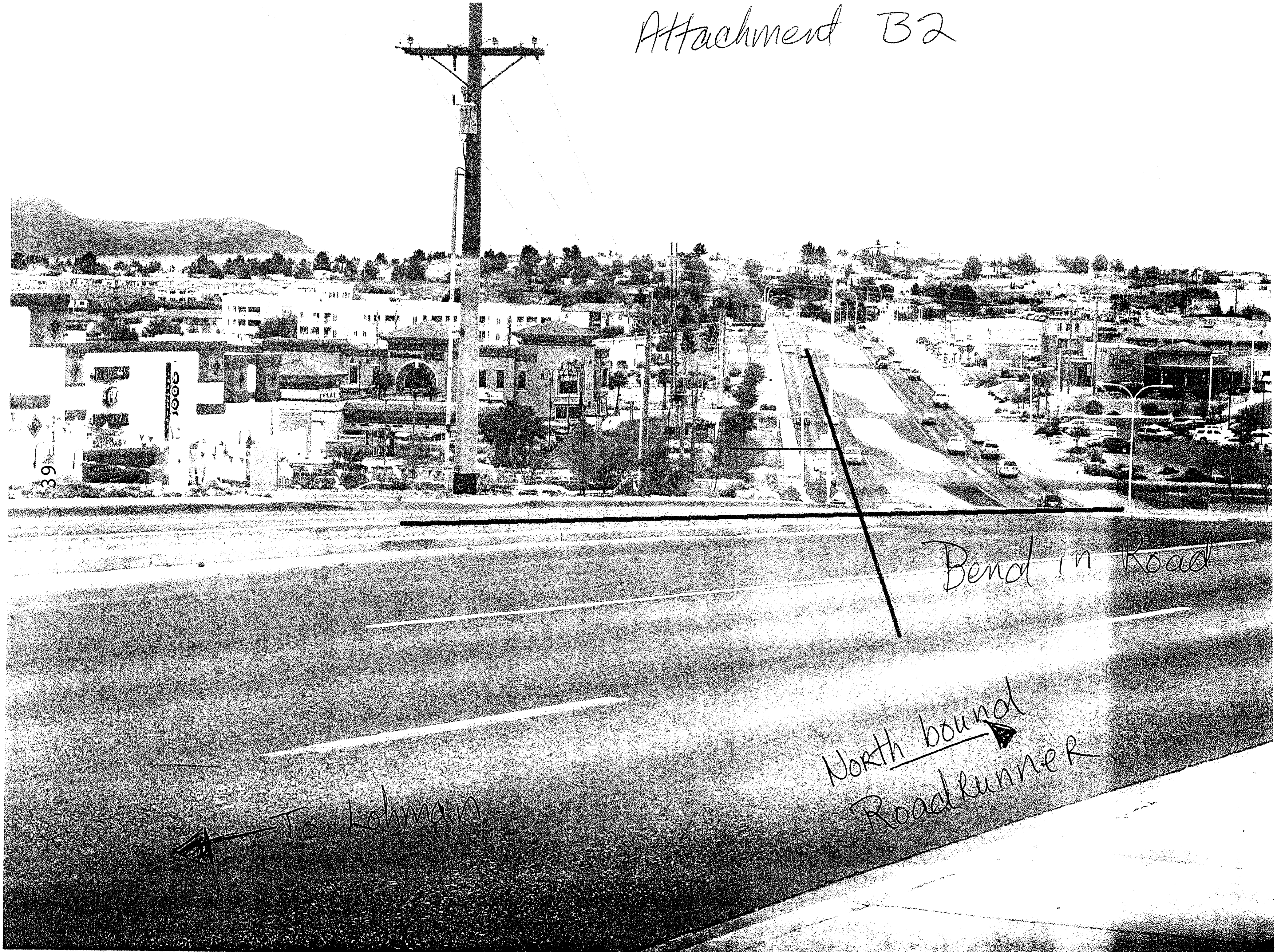
H – Rough placement and size of sign

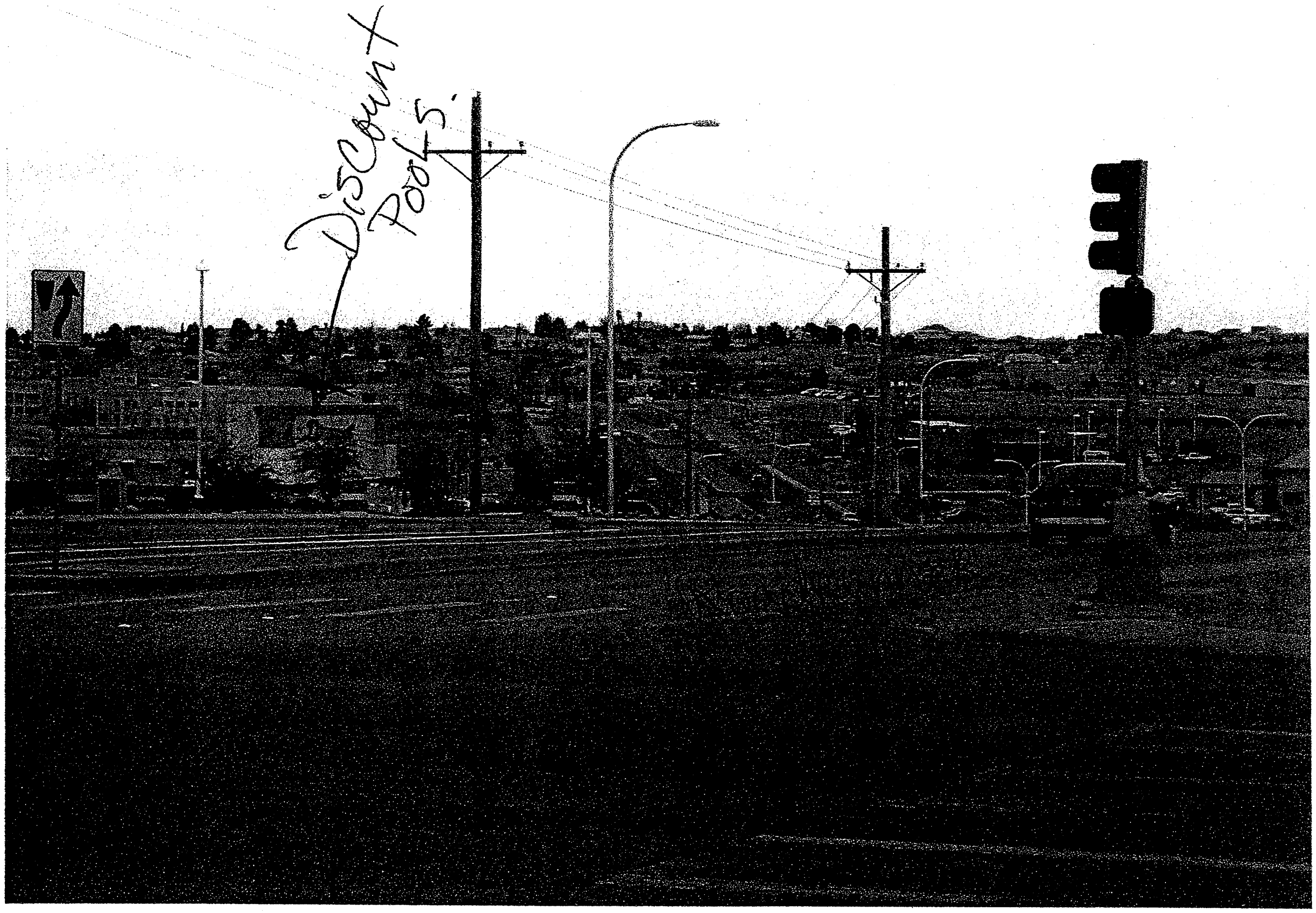
~~Append~~ Attachment A1

Attachment B1



Attachment B2

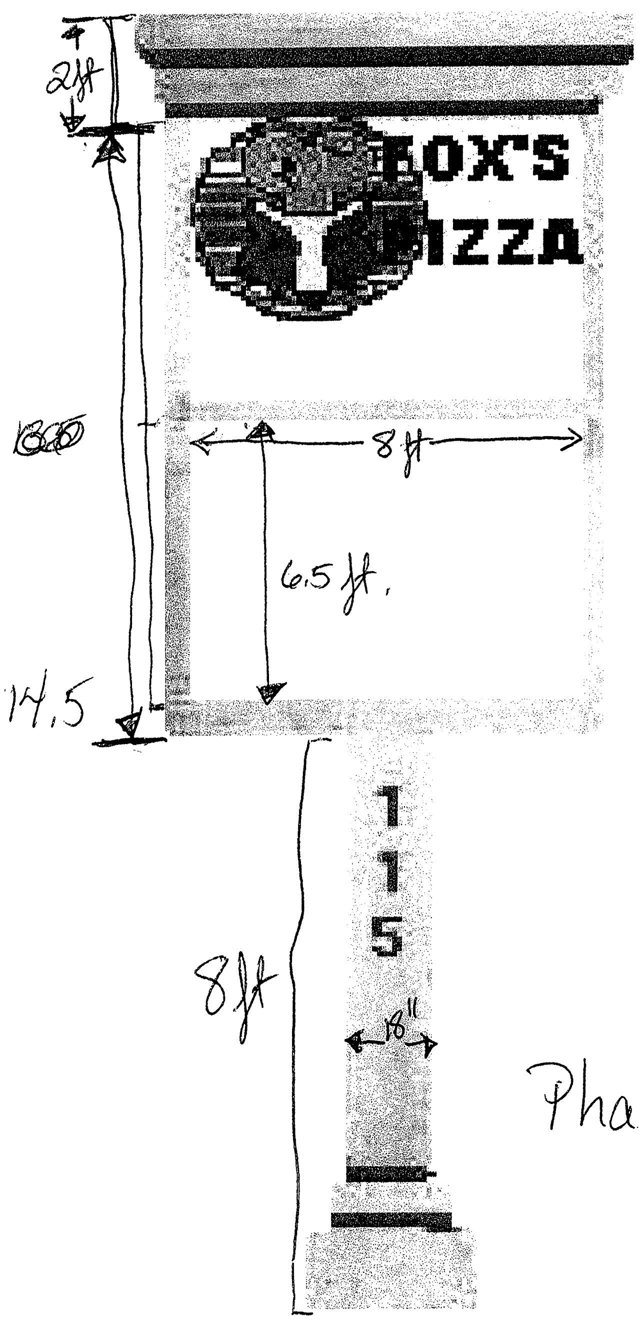




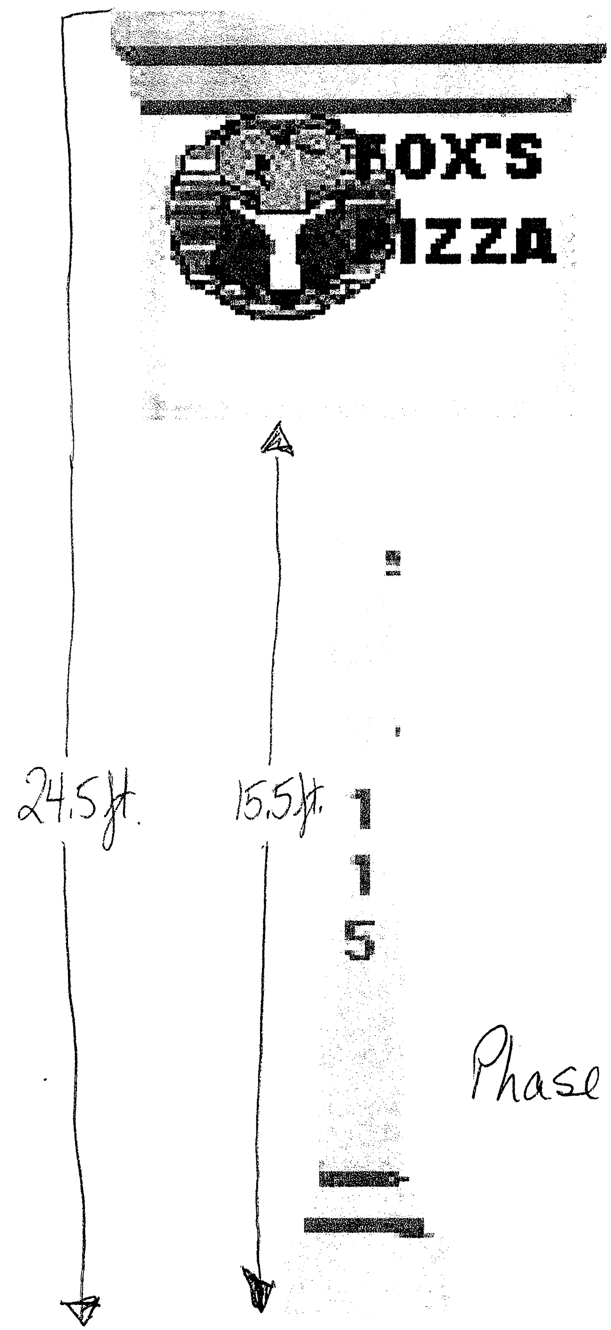
Attachment B3

E

Attachmen C1

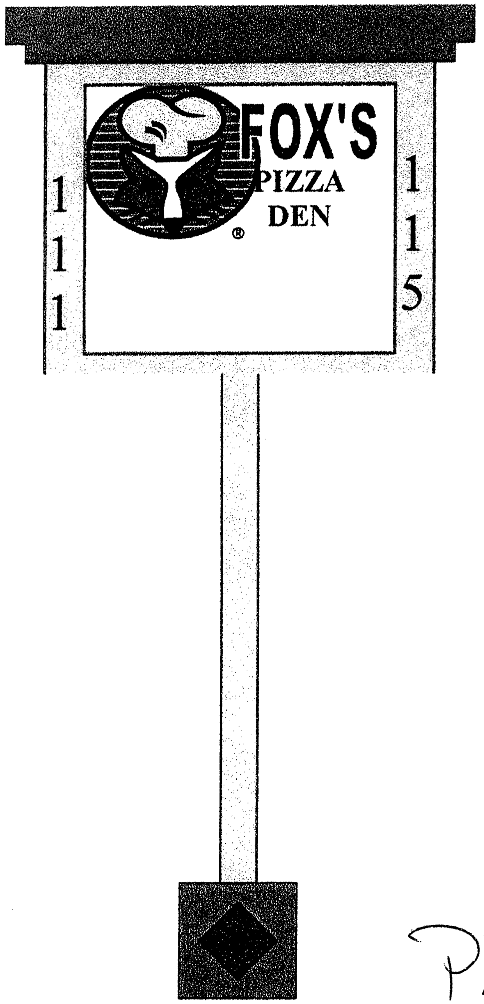


Phase 2

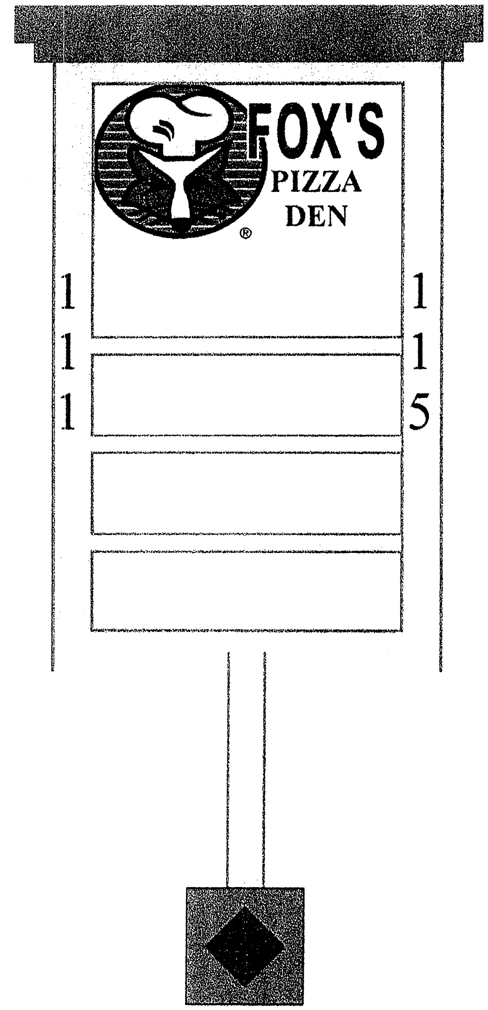


Phase 1

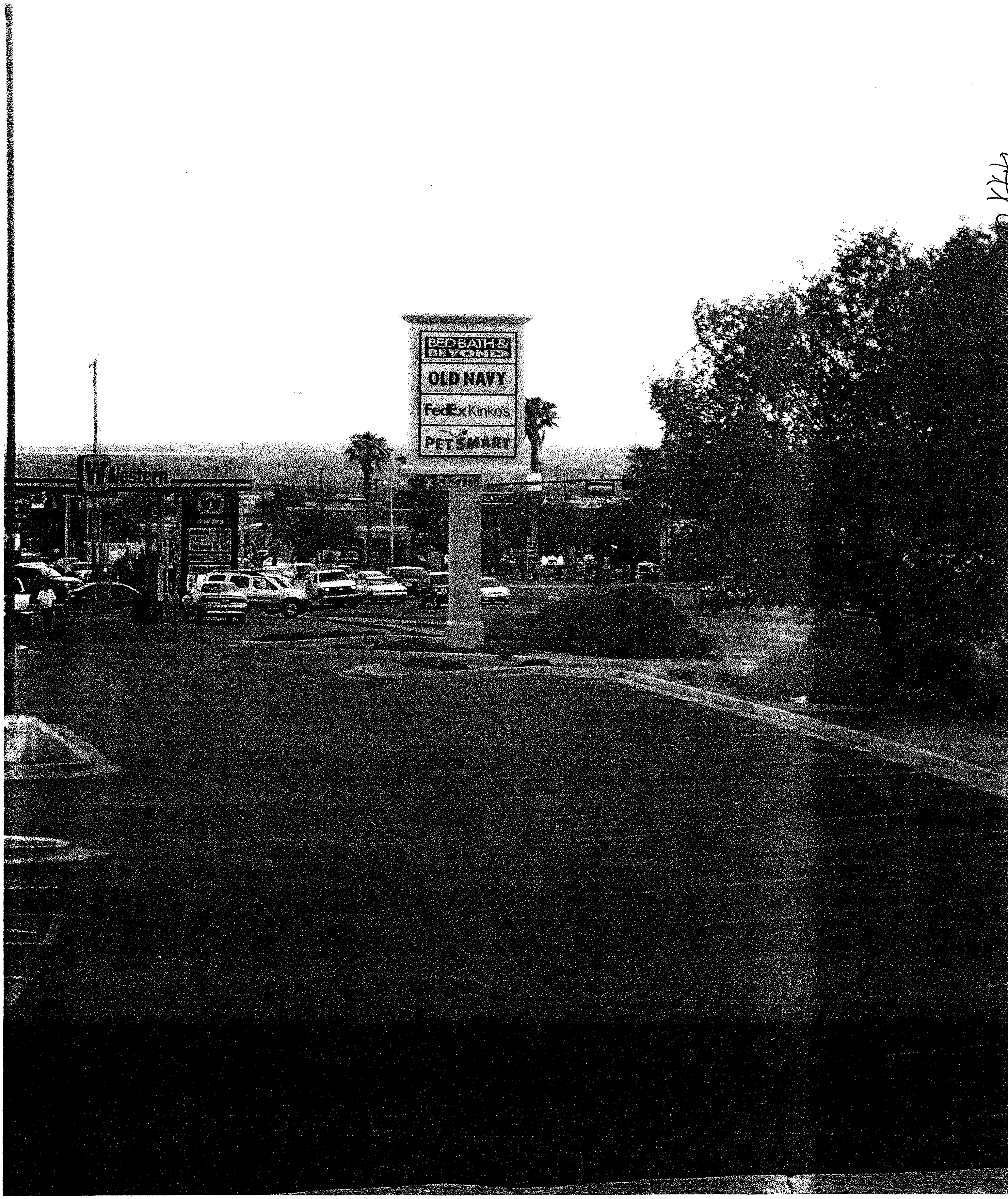
Attachment C2



Phase 1



Phase 2


BED BATH & BEYOND
OLD NAVY
FedEx Kinko's
PETSMART
Western

Model Guidelines for Visibility of On-Premise Advertisement Signs

BEVERLY THOMPSON KUHN, PHILIP M. GARVEY, AND MARTIN T. PIETRUCHA

On-premise advertising signs play an important role in directing drivers. Well-placed and well-designed on-premise advertising signs can guide vehicle operators toward their destinations with minimal demand for attention. Poor placement of signs can sap a driver's cognitive and perceptual resources, resulting in erratic maneuvers such as inappropriate slowing and lane changing. Increasingly, however, the visibility of on-premise advertising signs is being determined not by human factors researchers, visibility experts, or traffic engineers but by local planning and zoning officials, who lack specialized training in relevant fields. Regulations affecting on-premise sign visibility characteristics, such as means of illumination, lateral offset, and sign size, have been established mainly on the basis of arguments for improved aesthetic appeal and of vague, often unsubstantiated safety claims. There is a clear need to determine, from scientific and ergonomic perspectives, the effects these regulations have on sign visibility and traffic safety. An organized synthesis of existing literature on sign visibility based on 60 years of research and consisting of more than 150 journal articles and technical reports is presented. The synthesis may be used by sign designers to optimize the visual effectiveness of their signs. It also can provide a scientific basis for the development of new on-premise sign regulations or changes to existing regulations. A model set of guidelines for designing and locating on-premise advertisement signs for conspicuity and legibility is provided.

Advertising signs play an important role in directing drivers. Well-placed and well-designed advertising signs can guide vehicle operators toward their destinations with minimal demand for attention, whereas poor placement of advertising signs can sap a driver's cognitive and perceptual resources. This distraction can result in erratic maneuvers such as inappropriate slowing and lane changing.

Integral to navigation, advertising signs are a necessary traveler aid (*1*), as important in some instances as highway guide signs are for conventional road navigation. This relationship between signing for highways and signing for businesses is accepted by the highway signing community, as evidenced by the recent proliferation of tourist-oriented directional signs (TODs) and logotype signing. Increasingly, however, the visibility of advertising signs is being determined not by human factors researchers, visibility experts, or traffic engineers but by local planning and zoning officials, who lack specialized training in relevant fields. Regulations delineating advertising-sign visibility characteristics, such as means of illumination, lateral offset, and sign size, have been established mainly on the basis of arguments for improved aesthetic appeal and of vague, often unsubstantiated safety claims. There is a clear need to determine, from scientific and ergonomic perspectives, the effects these regulations have on sign visibility and traffic safety.

B.T. Kuhn, Texas Transportation Institute, 7715 Chevy Chase Drive, Suite 4. 160, Austin, Tex. 78752. P.M. Garvey and M. T. Pietrucha, Pennsylvania Transportation Institute, Pennsylvania State University, 201 Research Office Building, University Park, Pa. 16802-4710.

The purpose of this research was to provide an organized synthesis of existing literature on sign visibility. On one level, the synthesis can be used by sign designers to optimize the visual effectiveness of their signs. On another level, it can provide a scientific basis for the development of new on-premise sign regulations or changes to existing regulations. The last section of this study provides a set of guidelines for designing on-premise advertisement signs.

SIGN VISIBILITY RESEARCH

To review the sign visibility literature, it is useful to divide the research by the type of visibility studied. The two main sign visibility research areas are sign detection, which is a function of sign conspicuity, and sign legibility. These two research areas are interdependent; a sign cannot be read if it cannot be found, and there is little reason to detect a sign that cannot be read from the road. However, for sign design and placement, the characteristics that affect legibility and detection differ enough qualitatively to warrant separate consideration.

Detection

A sign's detectibility is directly related to its conspicuity. If a sign is highly conspicuous it will be detected from a greater distance than if its conspicuity is low. While this relationship is fairly obvious, the variables that determine sign conspicuity may be less so. This section addresses conspicuity and the characteristics of the environment, sign, and driver that directly affect both the likelihood and distance of sign detection.

Sign Placement Variables

The most important factor in sign detection—sign placement—has nothing to do with the physical sign itself. Because a sign that is not well placed cannot be seen and therefore cannot be read, a sign's position in its environment is key to its effectiveness. This section addresses sign mounting height and offset and the immediate sign environment.

Lateral and Vertical Offset Careful placement of signs along the roadway ensures that a driver has plenty of time to detect the sign and take necessary action. Upchurch and Armstrong (*2*) found placement of signs with respect to restricting geometric features of the roadway, such as hills and curves, to be important in maximizing detection distance. Mace and Pollack (*3*) stated that as the distance between a target sign and noise items (non-target-sign items) increases, the sign becomes more conspicuous, although this conspicuity is eroded as the sign becomes located further from the center of the driver's visual field. Claus and Claus (*4*) quantified this, writing that signs should be placed within 30 degrees of the driver's line of sight. It has been suggested that signs be located within an optimal cone of vision, approximately 10 to 12 degrees on the horizontal axis and 5 to 8 degrees on the vertical axis (*5*). Jenkins and Cole (*6*) concurred by suggesting that a sign will be noticed if it is within 10 degrees of a driver's line of sight. Jenkins and Cole's conclusions are supported by Zwahlen's study (*7*) of nighttime traffic sign conspicuity in the peripheral visual field. Zwahlen found that retroreflective signs placed in the foveal region resulted in twice the detection distances of those located 10 degrees outside this central visual area. Zwahlen also found that signs located 20 and 30 degrees outside the fovea resulted in one-third and one-quarter the detection distances, respectively, of those located within the foveal region.

As indicated by Zwahlen's study, sign placement is particularly important for retroreflective signs. This is because the angle between the vehicle and the sign strongly influences nighttime sign detection (*8*). A retroreflective material returns light to its source as a function of divergence and entrance angles, which describe the relative positions of the driver, headlamps, and sign. As these angles increase, the amount of reflected light seen by the driver decreases (*1*). Thus, for retroreflective signs it is important to obtain divergence and entrance angles as close to the manufacturer's recommendations as is possible.

Surround A sign's placement relative to other visual stimuli defines the visual complexity of the sign's surround. The factors that affect visual complexity include the number and overall density of distractor items in the driver's visual field, and the density of these items immediately adjacent to the sign (*3*). Research conducted on signs with various levels of retroreflectivity in different environments reveals that virtually any retroreflective sign can be seen at a reasonable distance in an environment that is not visually complex (*3*). In other words, if a sign does not have to compete with many other objects in a driver's cone of vision, it is conspicuous, even if its retroreflectivity is low. However, in an area that has more visual distractions, sign conspicuity becomes more a function of retroreflectivity, size, color, and other variables (*3,9*). McNees and Jones (*8*) support Mace and his colleagues when they assert that as the number of objects in the driver's cone of vision increases, the conspicuity of a sign decreases. For a sign located in a visually complex environment, retroreflectivity may not be enough to ensure sign detection (*3*). Thus, in more complex environments, some conspicuity boosters will be necessary to achieve a desired detection distance. In such situations, additional lighting or sign redundancy may be necessary to provide adequate conspicuity that will ensure timely sign detection.

Lighting Variables

The first step in visual functioning is the detection of light. Differences in the quantity (i.e., luminance) and quality (i.e., color) of light are necessary to differentiate objects. A sign with the same luminance or color as its background will be difficult, if not impossible, to detect. Therefore, the term *lighting variables*, as used in this section, refers not only to illuminated nighttime sign display but also to all factors that fall within the category of photometric sign properties. Although this category includes nighttime illumination techniques, it also covers contrast between the sign and its surroundings, daytime and nighttime sign luminance, sign color, and color contrast between the sign and its surroundings.

External Contrast External contrast is the difference between the luminance of the sign and the area immediately surrounding the sign. As a sign's external contrast ratio increases, so does the sign's conspicuity. Various researchers (*3,10,11*) have concluded that in low-visual-complexity locations, external contrast, along with sign size, is the major determinant of sign detection. Cooper (*12*) goes a step further by stating that external contrast plays a far greater role in sign conspicuity than does sign size. While no research was found to provide optimum and minimum values for external contrast, McNees and Jones (*8*) found that high-intensity background sheeting with high-intensity stick-on copy, opaque sheeting with button copy, and engineering-grade background sheeting with button copy all provide acceptable freeway guide sign detection distances.

Sign Luminance Mace and Pollack (*3*) stated that sign conspicuity increases with increased sign luminance. Furthermore, Mace et al. (*11*) concluded that, with the exception of black-on-white signs, increasing sign luminance can offset the detrimental effects of increased visual complexity. Pain (*13*) stated that higher brightness enhances a high brightness ratio by approximately 10 percent. Zwahlen (*7*) buttressed the findings of these researchers with his conclusion that increasing retroreflective sign specific intensity per unit area (SIA) values can offset the negative effects of their location in the periphery. The SIA of a sign is the ratio of reflected light to incident light. Research conducted on various types of commonly used retroreflective background sheeting combined with reflective copy concurs, indicating that conspicuity increases as sign retroreflectivity increases (*8*).

Nighttime conspicuity research conducted by Mace et al. (*9*) indicated that the relationship between sign brightness and detection distance may be more complex than the previous studies had indicated. Mace et al. (*9*) found no difference in detection distance for either black-on-white or black-on-orange signs as a function of retroreflective material (e.g., 3M engineering grade, high-intensity, and diamond grade). However, an improvement in detection distance for white-on-green signs at both high and low visual complexity sites was found with higher-reflectance materials. Increases in detection distances of more than 30 percent were found with 3M diamond grade background sheeting, compared with the engineering grade. Research of white-on-green signs has gone further in reporting that sign brightness can compensate for sign size. Mace et al. (*9*) found that small (61-cm [24-in.]) diamond grade signs produced the same legibility distance as large (91-cm [36-in.]) engineering grade signs.

Color Forbes et al. (*14*) concluded that relative brightness is most important, but color contrast enhances brightness in some cases. Of the sign background colors black, light grey, and yellow, Cooper (*12*) found yellow to be the most effective color. Black-on-orange and white-on-green signs were detected at greater distances than black-on-white signs (*9*). This is consistent with the research of Jenkins and Cole (*6*) that found black-on-white signs to provide particularly poor conspicuity. Mace et al. (*9*) concluded that the white signs were being confused with other white light sources and that it was necessary to get close enough to the sign to determine its shape before recognizing it as a sign. The research by Mace et al. punctuates the important role that unique sign characteristics play in determining sign conspicuity. Zwahlen and Yu (*15*) furthered the understanding of the role of color in sign detection when they reported their findings that sign color recognition distance was twice that of shape recognition, and that the combination of a highly saturated color and specific shape of a sign could double a sign's average recognition distance.

Sign Variables

In addition to environmental and photometric variables, several characteristics related to sign structure and content have an effect on sign detection by drivers. These characteristics include the size and shape of the sign, the manner in which the message is displayed, and the presence or absence of a border.

Size and Shape The size and shape of a sign relative to other stimuli in the driver's field of vision help determine the sign's conspicuity. Mace et al. (*9*) found significant increases (around 20 percent) in both nighttime and daytime detection distances with increases in sign size from 61 cm to 91 cm for black-on-white, black-on-orange, and white-on-green signs. In 1986, Jenkens and Cole conducted a study that provides corroborative evidence that size is a key factor in sign detection. Jenkins and Cole (*6*) concluded that sign sizes between 38 cm (15 in.) and 89 cm (35 in.) are sufficient to ensure conspicuity and that if signs this size or bigger are not detected, the problem is with external contrast or surround complexity. In addition to the effects of sign size, Mace and Pollack (*3*) concluded that conspicuity also increases if the shape of the sign is unlike that of other signs in the area.

Display Forbes et al. (*6*) found that green signs with high internal contrast improve sign detection. In particular, they found that signs with bright characters on a dark background have the highest conspicuity under light surround conditions and that the reverse is true for dark or nighttime surround conditions. Hughs and Cole (*16*) suggested that bold graphics and unique messages increase the likelihood of meaningful detection.

Border Research on highway sign detection conducted by Cole and Jenkins (*17*) concluded that edge definition, which can be enhanced by the use of borders, was important in determining conspicuity.

Legibility

After detecting a sign, the operator must read its content. Legibility differs from comprehensibility in that legibility does not infer message understanding. Symbol signing provides a good example of this distinction. An observer can visually discern the various parts of a symbol but be unable to correctly report that symbol's meaning. The same is true for alphanumeric messages with confusing content. The problem with drawing a distinction between legibility and comprehension, however, is that familiar symbolic and textual messages are reported accurately at much greater distances than is novel sign copy. This well-documented phenomenon leads to the need to distinguish pure legibility from copy recognition. Because recognition introduces cognitive factors, copy recognition does not require the ability to discriminate all the copy elements—all the letters in a word or all the strokes in a symbol—for correct copy identification to occur. Familiar word or symbol recognition can be based on global features. Sign copy recognition distances therefore are longer than would be predicted by either visual ability or sign characteristics alone. In fact, one of the best ways to improve sign reading distance is not through manipulation of sign characteristics but by making the sign copy as familiar to the target audience as possible.

Improving sign legibility can enhance the reading distance for both novel and familiar content. For example, a sign with 1.2-m (4-ft) characters reading "Ishtar's Diner" will be read at a greater distance than a 0.3-m (1-ft) McDonald's Golden Arches sign. The following sections detail more than 60 years of research aimed at improving sign legibility. The research emphasizes the importance of sign characteristics such as photometric properties and symbol and textual shape.

Lighting Variables

In traffic sign visibility research, nighttime sign visibility typically is measured as a function of sign luminance and daytime legibility, by internal luminance contrast ratio. The role of lighting variables in sign legibility probably is one of the best-researched areas in the sign visibility field.

Internal Contrast What probably is the most well-accepted optimum contrast value for sign legibility was derived by Sivak and Olson. Sivak and Olson (*18*) reviewed the sign legibility literature pertaining to sign contrast and derived a contrast ratio of 12 : 1 for positive contrast signs by using the average of the results of six separate research efforts. This 12 : 1 ratio would, for example, result in a sign with a 24-cd/m^2 legend and a 2-cd/m^2 background. This single, optimal ratio was expanded in a 1995 synthesis report by Staplin (*19*) that gave a range of acceptable internal contrast levels between 4 : 1 and 50 : 1.

Sign Luminance Whereas Khavanin and Schwab (*20*) and Colomb and Michaut (*21*) concluded that only small increases occur in nighttime legibility distance with increases in sign retroreflectivity, Mace (*22*) and Garvey and Mace (*23*) found that increasing the brightness of a sign improves nighttime legibility distance. McNees and Jones (*8*) found that the selection of retroreflective background material has a significant effect on sign legibility. These researchers found four combinations of sheeting and text to provide acceptable legibility distances for freeway guide signs: button copy text on superengineering grade background sheeting; high-intensity text on high-intensity background; high-intensity text on superengineering grade background; and high-intensity text on engineering grade background. Earlier research by Harmelink et al. (*24*) found that observers favored high-intensity text on engineering grade background, stating that this combination provided contrast ratios as good as those produced by high-intensity text on high-intensity background. However, Garvey and Mace (*23*) also found that the combination of diamond grade text on engineering grade background produced too high a contrast, which impeded legibility.

On the basis of a review of the literature, Sivak and Olson (*25*) suggested an optimal nighttime sign legend luminance of 75 cd/m^2 and a minimum of 2.4 cd/m² for black-on-light (negative contrast) signs. With light-on-dark (positive contrast) signs, Garvey and Mace (*23*) found 30 cd/m² to provide maximum nighttime legibility distance. Again using positive contrast signs, Garvey and Mace (*23*) found that daytime legibility distance continued to improve with increases in luminance up to 850 cd/m², after which performance leveled off.

Lighting Design Overall, the literature indicates that a sign's luminance and contrast have a greater effect on sign legibility than do the specific means used to achieve these levels. No significant difference in legibility distance between lighted and unlighted overhead-mounted retroreflective signs for a variety of sign materials had been found (*8*). Other research extends this finding, indicating no significant difference in legibility distances for up to 10 different sign lighting system types for freeway guide signs (*8,26*). In a study of changeable message sign (CMS) visibility, Garvey and Mace (*23*) tested a sign by using retroreflective and self-illuminated lighting design and found equivalent legibility distances. Garvey and Mace did, however, find that the use of "black light" fluorescent lighting severely reduced legibility. This was attributed to a reduction in internal luminance contrast and color contrast. Hussain et al. (*27*) addressed this problem in their recommendation for the use of "white" fluorescent lamps for optimum color rendition and metal halide for overall performance (including color rendition) and cost effectiveness.

Sign Variables

Sign Placement Sign placement is as important to sign legibility as it is to detection. First, there is the obvious need to place a sign so that its message is not blocked by traffic, pedestrians, buildings, or other signs. Another requirement for sign placement involves the angle between the observer location and the sign. Signs set at large angles relative to the observer location can result in letter and symbol distortion. It has been recommended that the messages on signs at angles greater than 20 degrees be manipulated (e.g., increased in symbol height or width) to appear "normal" to the observer (*28*).

Text Versus Symbols In a study of traffic sign comprehension speed, Ells and Dewar (*29*) found symbolic signs to outperform those with textual messages. These researchers also discovered that symbolic signs were less susceptible than were text signs to visual degradation. In a 1975 visibility study, Jacobs et al. (*30*) assessed the legibility distance of almost 50 symbols and their textual counterparts. These researchers found that in almost all cases, the legibility distance for the symbols was twice that of the alphanumeric signs. This finding was replicated by Kline and Fuchs (*31*) for a smaller set of symbols by using young, middle-age, and older observers. Kline and Fuchs also introduced a technique to optimize symbol legibility. The technique results in symbols designed to "maximize contour size and contour separation." In other words, optimized symbols or logos will have elements that are large enough to be seen from a distance and will have spaces between the elements wide enough to reduce blurring between elements.

The literature clearly indicates that for visibility symbols are superior to text. Symbols, however, require a different kind of comprehension than words. Symbol meaning is either understood intuitively or learned. Although traffic sign experts and traffic engineers agree that understandability is the most important factor in symbol design (*32*), research has shown that what is intuitive to designers is not always intuitive to drivers and that teaching observers the meaning of more abstract symbols frequently is unsuccessful. For example, in one study (*33*) the relatively simple "hill" symbol resulted in only 85 percent comprehension, and the "road narrows" symbol accommodated only 52 percent of the respondents. Care should be taken, therefore, to display information in a symbolic format that the target audience readily understands.

Uppercase Versus Mixed Case Forbes et al. (*34*) conducted what are perhaps the definitive studies on the difference in legibility between text depicted in all capital letters and that shown in all lowercase with an initial capital letter. When uppercase and mixed-case words took up the same sign area, Forbes et al. (*34*) found a significant improvement in legibility distance with the mixed-case words. Garvey et al. (*35*) replicated this result with new sign materials, a different font, and older observers. Garvey et al. (*35*) found a 12 to 15 percent increase in legibility distance with mixed-case text under daytime and nighttime conditions. These results were obtained with a recognition task—the observers knew what words they were looking for. In instances in which the text is not known to the observer, improvements with mixed-case are not evident (*9,34,35*).

Font No data on the legibility distances of the range of fonts used in on-premise signing are available. Assessing the effect of letter style on traffic signs has been limited by state and federal governments' desire to keep the font "clean"—governments want a sans serif alphabet that has a relatively constant stroke width. Although sans serif letters generally are considered to provide greater legibility distance than serif letters (*28*), a comparison of Highway Gothic, the sans serif standard highway font, with Clarendon, the serif standard National Park Service font, however, revealed a slight improvement with the Clarendon font (*9*).

Stroke Width Kuntz and Sleight (*36*) concluded that the optimal stroke width-to-height ratio for both positive and negative contrast letters was 1:5. Forbes et al. (*37*) found increases in legibility distance of fully reflectorized, positive contrast letters and decreases in legibility for negative contrast letters when the stroke width-to-height ratio was reduced from 1 : 5 to 1 : 7. That is, light letters on a darker background should have a thinner stroke and dark letters on a lighter background should have a bolder stroke. Improved legibility for fully reflectorized, white-on-green signs with thinner stroke width also was found by Mace et al. (*9*) for very high contrast signs, and by Garvey et al. (*35*) for mixed-case text.

Abbreviations In a study of changeable message signs comprehension, Huchingson and Dudek (*38*) developed several abbreviation strategies. These researchers recommended the technique of using only the first syllable for words having nine letters or more—for example, *Cond* for *Condition*. This technique should not be used, however, if first syllable is itself a word. A second method using the key consonants was suggested for five- to seven-letter words—for example, *Frwy* for *Freeway*. Abbreviations, however, are to be used only as a last resort because of limitations in sign size since they increase the possibility of incorrect sign interpretation.

Alternate suggestions to deal with sign size limitations include selecting a synonym for the abbreviated word, reducing letter size, reducing message length, or increasing sign size.

Letter Height Research indicates that legibility distance increases as letter height increases, although there is a point of diminishing return (*20,39*). For example, doubling the letter height will increase but will not double sign legibility distance. Mace et al. (*9*) and Garvey and Mace (*23*) found that increases in letter height above 20.3 cm (8 in.) resulted in nonproportional increases in legibility distance. One study (*23*) found that a sign with 107-cm (42-in.) characters produced only 80 percent the legibility index of the same sign with 46-cm (18-in.) characters. That is, the 107-cm character produced a legibility distance of approximately 412 m (1,350 ft), or 3.8 m/cm (32 ft/in.), whereas the 46-cm characters resulted in a legibility distance of about 244 m (800 ft) or 5.3 m/cm (44 ft/in.).

Contrast Orientation Positive contrast signs have light text on a dark background and negative contrast signs have dark text on a light background. The research on this issue is clear; with the possible exception of tight intercharacter spacing (*40*), positive contrast signs provide greater legibility distances than negative contrast signs. As far back as 1955, laboratory research, by Allen and Straub (*41*), found that white-on-black signs (positive contrast) provided longer legibility distances than black-on-white signs when the sign luminance was between 3 and 30 cd/m^2. Allen et al. (*39*) replicated these results in the field. In a study of CMSs, Garvey and Mace (*23*) extended these results with the addition of orange, yellow, and green signs. Use of positive contrast signs resulted in improvements of about 30 percent over negative contrast signs (*23*).

Color Garvey and Mace (*23*) found that color produced no difference in legibility distance that could not be accounted for by luminance, luminance contrast, or contrast orientation between signs using the following color combinations: white/green, black/white, black/orange, black/yellow, and black/red. In other words, if appropriate luminance contrast, color contrast, and luminance levels are maintained, the choice of specific colors for background and text will not affect legibility distance.

VISIBILITY GUIDELINES FOR ON-PREMISE SIGNS

The visibility guidelines for on-premise signs were developed to be used by designers to optimize visual effectiveness of their signs. The main objective in developing the visibility guidelines was to provide research-based information that would improve the likelihood of sign detection and ensure that if a sign is detected it will be legible at an appropriate distance. A secondary objective was to address the effect on sign legibility of deviation from optimal sign design.

For an on-premise sign to be visually effective, it must be readable. For an on-premise sign to be maximally efficient for visibility, it need only be readable at some minimum distance that allows the driver to take in the sign content and respond to the sign safely. This is the minimum required legibility distance (MRLD). From a strict visibility perspective, to make a sign readable at distances greater than the MRLD would not be cost-effective because doing so would require a larger sign.

Before a sign can be read it must be detected. Again, for visibility, signs do not have to be detected at distances greater than the MRLD. To see a sign but be unable to read it is pointless and, some argue, may cause the observer to "shed" or disregard the sign before it becomes readable. Therefore, the MRLD drives the minimum required detection distance (MRDD). The MRDD should be equal to or just greater than the MRLD. The MRLD's major components are decision sight distance (DSD) and travel speed.

Decision Sight Distance

The first step in determining the MRLD is to establish the time necessary to read the sign, process the information, and make the maneuver required by that sign. With on-premise signs, the required maneuver is an exit. In the worst case, the full scenario is a lane change, speed reduction, and either a left or a right turn out of the traffic flow. A recent synthesis of DSD literature (*42*) suggests a conservative value of 5.5 sec to complete this sequence of events with signs that contain five or fewer critical elements. This includes a conservative 1.5-sec interval for an alerted traveler to read the sign and initiate a response (*43*), combined with a 4-sec interval to complete the speed reduction and lane-change maneuver (*44*).

Travel Speed

The second step in determining the MRLD is to establish the vehicle rate of speed. Vehicle speed will define the distance required to allow for the 5.5 sec of DSD; the faster a vehicle is moving, the greater is the MRLD. The MRLD will, in turn, drive letter height and therefore sign size. The MRLD also will affect the sign's viewing angle because signs further downstream are closer to a driver's central field of vision. Table 1 provides the MRLD for on-premise signs at various approach speeds. The accompanying letter heights are based on a legibility index (i.e., legibility distance as a function of letter height) of 3.6 m/cm, and as such will accommodate the majority of vehicle operators at these distances. The 10 degree lateral offsets provide setback distances that will conform to literature recommendations for sign detection. For example, if a sign's MRLD is 168 m (551 ft) and its setback is between 0 and 29.6 m (97 ft) to the left or right of the observer's line of sight, then that sign will be within a 10 degree lateral offset. Table 1 also shows the mounting height that will place the sign at the recommended 5 degrees above the observer's line of sight at the MRLD. It must be kept in mind, however, that if the sign is not detected at the MRLD, both the lateral and vertical offset angles continue to increase until the vehicle is alongside the sign.

Basic Assumptions and Specified Variables

Many factors contribute to sign legibility and detectibility. Most of these factors interact with each other and improvements made to some factors can overcome deficiencies in others. Most notably, increased letter height can compensate for almost any sign defect, but increased letter height results in larger, more expensive signs. Since it is important financially and aesthetically to keep sign size down, the guidelines described here optimize sign legibility distance while minimizing sign size. Because sign size is the direct result of letter height (which in turn is determined by driver visual acuity), sign size is kept to a minimum by recommending the smallest letter

TABLE 1 Appropriate Letter Height and Sign Location

Vehicle Speed (kph)	Vehicle Speed (m/sec)	DSD (sec)	MRLD (m)	Uppercase Letter Height[a] (cm)	Lateral Offset[b] (m)	Mounting Height[c] (m)
30	8.3	5.5	46	12.7	8.1	4.0
40	11.1	5.5	61	17.0	10.8	5.4
50	13.9	5.5	76	21.2	13.5	6.7
60	16.7	5.5	92	25.5	16.2	8.0
70	19.4	5.5	107	29.7	18.9	9.4
80	22.2	5.5	122	34.0	21.6	10.7
90	25.0	5.5	137	38.2	24.2	12.0
100	27.8	5.5	153	42.4	26.9	13.4
110	30.6	5.5	168	46.7	29.6	14.7
120	33.3	5.5	183	50.9	32.3	16.0

[a]Based on legibility index of 3.6 meters per centimeter
[b]Based on 10-degree lateral offset
[c]Based on 5-degree vertical offset

height that will be legible to most drivers. For this letter height to be legible, however, certain basic assumptions were made and sign factor values specified. If a designer deviates from the assumptions and specified variables, correction factors will have to be applied to the DSD, the MRLD, or the letter heights shown in Table 1. The following sections describe the basic assumptions made in developing Table 1 and provide correction factors to accommodate deviations from these assumptions.

Basic Assumptions

The Sign Is Perpendicular to the Observer's Line of Sight Messages displayed on signs at angles to the observer greater than 20 degrees will appear distorted. To some extent, this distortion can be remedied by adjusting letter or symbol width or height. This will create a sign that appears distorted when viewed perpendicularly but appears normal from the intended sign viewing position.

The Sign has Five or Fewer Critical Elements A critical element is any aspect of a sign (e.g., word, symbol, or color code) that an observer must comprehend to act on the sign. If a sign has more than five critical elements, more time must be allotted for sign reading. One sec should be added to the DSD in Table 1 for every three additional critical elements. This will require an increase in the MRLD and, therefore, an increase in letter height.

The Observer Is Alert and Looking for the Sign The majority of meaningful on-premise sign detection situations occur when the traveler is looking for the sign. However, from a business owner's point of view, it is desirable for an on-premise sign to attract the attention of travelers who are not specifically looking for that business. If a traveler is not looking for a sign, sign conspicuity must be increased to attract the traveler's attention by the MRDD. Methods for improving sign conspicuity are detailed in a later section.

The Observer Is Not Familiar with the Sign If a traveler is looking for an on-premise sign and is familiar with the sign, then the DSD will be shorter because of reduced reading time. The required letter height also would be smaller. Letter height in Table 1 was established by dividing the MRLD by 3.6 m/cm, which is regarded as a conservative value for reading unfamiliar words. If the traveler's task merely is to recognize sign of which the traveler already have a mental picture, the divisor can be increased conservatively to 6 m/cm. This would cut the required letter size by 40 percent.

The Observer Has 20/40 or Better Visual Acuity The 3.6-m/cm letter height used to establish letter height in Table 1 is based on observers with 20/40 visual acuity, which is the standard cut-off for driver's licensure in most states.

Specified Variables

Copy Mainly Is Alphanumeric Signs that use symbols or icons to convey their messages can have greatly improved legibility distance over alphanumeric signs. If a sign's sole critical elements are symbolic, the size of the symbols of the symbols depends on the symbol's smallest critical element needed for recognition. If this results in a reduction in sign size, however, there will be a loss in sign conspicuity. Furthermore, the symbols must be meaningful to the traveler.

Copy Is Displayed in Mixed Case The use of uppercase-only letters can decrease reading or recognition distance of familiar words by 12 to 15 percent. If uppercase-only text must be used, the letter height should be increased by 15 percent to achieve the same reading or recognition distance as a mixed case message.

Copy Is Not Abbreviated Abbreviated text can require longer cognitive processing time and, therefore, result in longer DSDs. Unless the abbreviation is well-ingrained, the traveler would have to read and translate the abbreviation.

Copy Is Displayed in Positive Contrast Negative-contrast copy can reduce legibility distance by 30 percent. If negative-contrast text must be used, letter height should be increased by 30 percent.

Font Is Not Highly Ornate The data on which the guidelines were based were collected mainly with standard highway fonts. These are sans serif, equal-stroke-width fonts. Whether the guidelines can be generalized to other, more ornate fonts is not known.

Daytime Internal Contrast Is Between 4:1 and 50:1 Losses in legibility distance can be expected if the ratio between message luminance and background luminance falls below 4:1 or above 50:1. A luminance ratio below 4:1 results in a washed-out appearance and one above 50:1 results in letter irradiation or blooming, which reduces visibility.

Nighttime Sign Luminance Is Between 30 and 75 cd/m² Nighttime sign luminance refers to message brightness with positive-contrast signs and background brightness with negative-contrast signs. As with daytime internal contrast, and for the same reasons, falling below or exceeding recommended nighttime luminance values will result in a loss in legibility distance.

Conspicuity

Table 1 keeps the sign within 10 degrees of the traveler's central field of vision. This, however will not ensure detection. There are a number of ways to enhance sign conspicuity and therefore make detection at the MRDD more likely. Following are suggestions for improved sign conspicuity from sign visibility research efforts.

Surround Complexity

Where a sign is placed in relation to other visual stimuli defines the visual complexity of the sign's surround. Virtually any sign can be detected at a reasonable distance in an environment that is not visually complex. However, in an area that has more visual distractions, sign conspicuity becomes more a function of brightness, size, color, shape, and other variables.

Brightness Contrast

External contrast is the difference between the luminance of the sign and the luminance of the area immediately surrounding the sign. As a sign's external contrast ratio increases, so does the sign's conspicuity. Bright signs against dark backgrounds and darker signs against bright backgrounds are recommended.

Sign Border and Sign Color

Signs with well-defined edges are more easily detected than those without. A border around a sign provides good edge demarcation and provides contrast with the sign's background. A light border also can increase detection against a dark surround.

A sign's surround must be considered when selecting sign color. Good color contrast can be as important as good brightness contrast. For example, a red sign would blend into a red brick building. If good color contrast is obtained, there does not appear to be a color superiority effect favoring any one sign color. However, black-on-white signs have been found to provide particularly poor conspicuity, most likely because of their easy confusion with the many other white light sources in the roadway environment.

Sign Size and Shape

When visual complexity is low, a typical sign size should suffice to provide adequate detection distance. As visual complexity increases, sign size can help improve detection, because larger signs are more conspicuous and, therefore, result in greater detection distances than smaller signs. The relationship between sign size and detection distance is a positive one, although not directly proportional.

Sign conspicuity increases if the sign's shape is unlike that of other signs in the area.

Sign Display

High internal contrast improves sign detection. Specifically, signs with bright characters on a dark background should be used in areas with bright surround conditions, and signs with dark characters on a bright background should be used under dark surround conditions, although the latter will reduce legibility distance because of negative contrast. Bold graphics and unusual messages also will increase the likelihood of sign detection.

FUTURE RESEARCH

The guidelines and recommendations contained in this report are based on more than 50 years of research in the area of sign detection and legibility. There is still a good deal of research needed to improve our understanding of sign visibility. Answers to the following questions would greatly improve the visibility guidelines for on-premise signs:

- How does nighttime lighting design affect legibility and detection?
- What is the optimum amount of negative space (unused sign background area) and how should it be arrayed?
- How do sign size and brightness interact with offset and mounting height (can bigger, brighter signs have larger offsets)?
- What are the detection and legibility distances of signs that are in themselves symbols, such as the McDonald's arch and the Texaco star?
- What font produces the longest legibility distance for a given letter height?
- What is the legibility distance of typical on-premise sign fonts?
- What are the safety implications of conspicuous on-premise advertising signs that compete with traffic control devices?

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Attachment E

52

USSC

STANDARDS

On-Premise Signs
Guideline
Standards

Research Based
Approach To:
Sign Size
Sign Legibility
Sign Height

UNITED
STATES
SIGN
COUNCIL

On Premise Signs

United States Sign Council Best Practices Standards

A Research Based Approach To:

- Sign Size
- Sign Legibility
- Sign Height

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UNITED STATES SIGN COUNCIL

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the optimal usage of signs
as a vital communicative resource
within the built environment.

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PREFACE, The Advancement of Scientific Research

In 1996 the United States Sign Council and its research arm, The United States Sign Council Foundation, began research into the legibility and traffic safety implications of roadside on-premise signs. Prior to that time, very little research existed relative to the design and safety characteristics of this type of sign. Traffic engineers, seeking to develop a directional sign system to be used by motorists on local and interstate highways, had promulgated some earlier academic research. However, although useful as a starting point, the data had little relevance to the distinct qualities of private roadside signs. By virtue of their diversity and placement on private property, on-premise signs exist as a totally separate class of motorist-oriented communication, encompassing unique design challenges and traffic safety implications.

Since 1996, the United States Sign Council Foundation, in concert with traffic engineers, human factors researchers, and statistical analysts of the Pennsylvania Transportation Institute of the Pennsylvania State University, has published a series of research studies. The results from this work now provide a distinct and objective scientific basis for understanding the manner in which motorists receive and respond to the information content of the private, roadside sign system. The research and corresponding analyses afford designers and regulators of signs with an insight into the legibility, size, and placement characteristics necessary for effective roadside communication to occur. Coincidental with the work of the Pennsylvania State University research teams, other researchers, including teams studying the impact of sign systems serving the needs of an aging population on traffic safety, have arrived at conclusions essentially confirming the sign legibility and placement parameters discovered by the Pennsylvania State University researchers.

Four distinct volumes comprise the United States Sign Council / Pennsylvania Transportation Institute collaborative research work:

1) SIGN VISIBILITY, Research and Traffic Safety Overview (1996)
2) SIGN LEGIBILITY, The Impact of Color and Illumination on Typical On-Premise Sign Font Legibility (1998)
3) REAL WORLD ON-PREMISE SIGN VISIBILITY, The Impact of the Driving Task on Sign Detection and Legibility (2002)
4) SIGN VISIBILITY, Effects of Traffic Characteristics and Mounting Height (2003)

Together, these volumes, along with the aforementioned corroborating research provided by other teams, comprise the basis for the United States Sign Council Best Practices Standards for the design of roadside on-premise signs in dynamic motorist-oriented environments.

OVERVIEW, Seeing and Reading Roadside On-Premise Signs

The viewing of a roadside sign by a motorist involves a complex series of sequentially occurring events, both mental and physical. They can include message acquisition and processing, intervals of eye movement alternating between the sign and the road environment and, finally, active maneuvering of the vehicle itself as required in response to the stimulus provided by the sign.

Further complicating this process, is the dynamic of the viewing task itself. The subject must look through the constricted view frame of the windshield of a moving vehicle, with the distance between him/herself and the sign quickly diminishing. At 40 miles per hour, for example, the rate at which the viewing distance decreases is 58 feet per second; at 50 miles per hour, it becomes an impressive 88 feet per second. Because of this rapidly decreasing window of viewing opportunity, roadside sign design becomes highly challenging and critical to traffic safety. In addition, it necessitates the development of scientific standards for on-premise sign legibility, size, placement, and height in order to achieve effective roadside communication and maintain traffic safety.

Research has now been able to quantify the viewing process, such that measurement of the time necessary for a motorist to view and react to a roadside sign, while driving at a specified rate of speed, can be calculated. Using this time frame, or Viewer Reaction Time, and the amount of distance from the sign represented by that time frame, the optimal sign size required to transmit the message and allow sufficient time for detection, comprehension, and maneuvering can be calculated reliably.

The message content of the sign, usually composed of letterforms and/or symbols, sets the initial parameter for determining sign size. Once message content has been established and its length and/or complexity considered, sign size can be ascertained by assigning numerical values to the following:

1) Viewer Reaction Time
2) Viewer Reaction Distance
3) Letter Height
4) Copy Area
5) Negative Space

Each of these determinants is explained in detail below, along with the methodology for calculating their individual values. The size of the sign, then, can be computed either by summing these five determining values or by inserting them into the algebraic equation developed by USSC for that purpose. The result derived by using either method is the USSC standard for minimum sign size under dynamic roadside conditions.

DETERMINING SIGN SIZE – The Component Determinants

Viewer Reaction Time

The Viewing/Reaction Process

Viewer Reaction Time is a measurement of the total viewing and reaction time available to a driver reading a sign. It consists of four identifiable elements, each of which can be measured in components of elapsed time. They are:

1) Detection of the sign, noting it as a separate entity in a field of roadside objects;
2) The Message Scan, or fixation of view on the message contained on the sign;
3) The Re-Orientation Scan, or refocus of view from the message to the road environment at known intervals;
4) Driving Maneuvers as required in response to the message.

Detection

Detection of a specific sign as a recognizable element of the roadside landscape is a direct function of its *conspicuity*, or its ability to stand out from other objects within the field of view. The degree of conspicuity depends on a number of factors, including size, color, design, and placement, but even more specifically, the amount of contrast between the sign and its surrounding environment. Without some degree of conspicuity, a sign may lack detectability and cease to be a source of effective roadside identity or wayfinding communication.

Detection and Complexity of Driver and Sign Environment

Research has shown that detection is inversely related to the complexity of both the driving task and the landscape. Thus, as complexity increases for either or both the driving task and the visual environment, detection of any specific object within that landscape is likely to decrease. The more complex the landscape (e.g., city centers or multi-lane commercial corridors), the longer the time frame in the viewing cycle necessary and, therefore, the more conspicuous signs need to be for specific detection.

In this context, the effect of illumination can also have a profound effect on detectability, with the research verifying a pronounced increase in detection after dark for internally illuminated signs over similar signs viewed under daylight conditions.

Detection and Sign Orientation

Detectability is also a function of sign orientation, or the relative angle of view between the sign and the viewer. This angle has been shown to be at an optimum level when signs are positioned perpendicular to the viewer, and at initial detection, within a cone of vision extending 10 degrees to either side of the viewer. As confirmed by the research, "head-on", or perpendicular views, are far superior in detectability to parallel or side oriented views.

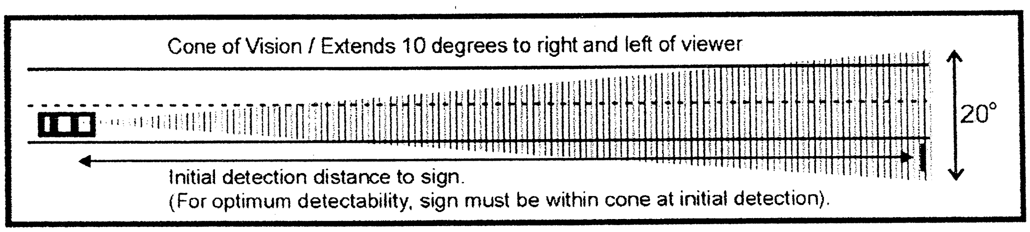


Figure 1. Cone of Vision and Detectability

Lateral Offset or Setback and The Cone of Vision

Lateral Offset, or Setback is the distance in feet at which the sign is offset to the right or left of the driver's eye position. It is critical to detectability because it determines the position of the sign either inside or outside the cone of vision at initial detection.

To assure optimal initial detection within the cone of vision, the sign should be located as close to the roadside as possible, so that the lateral offset is kept to a minimum. This usually means placement of the leading edge of a freestanding sign at the front property line, and signs on the sides of buildings as close to the front of the building as is practical. Arbitrarily imposed setback requirements increasing lateral offset beyond these parameters are generally counter productive to sign detection since they increase the distance of the sign from the driver's eye position, even if it is within the cone of vision.

It is important to note, as well, that roadside geometry affects any lateral offset calculation, which must include the number of road lanes, the width of the shoulder, and, in particular, the width of any utility or future right of way easements before the property line is reached; all of which add considerable lateral distance from the driver's eye position. In some instances in which public easements are large and initial detection distances are short, lateral offset may exceed the cone of vision inclusion even if the sign is placed at the property line. Increasing sign size, and therefore, visual range, is one solution to this detection problem, since as visual range increases, lateral offset is also increased.

Lateral offset from the viewer's eye position can be calculated through the application of the following equation in which:

L equals ten degrees of lateral offset.

D equals distance in feet from the sign at initial detection.

$$L = D\,(.176)$$

Thus, if initial detection distance from the sign is 300 feet, 10 degrees of lateral offset would be 52 feet. Note that this offset is from the driver's eye position, and not from some variable point, such as the edge of the road, road shoulder, or roadside easement.

Vertical Offset or Sign Height

Sign height limits which would enable sign detection without loss of eye contact with the road have variously been recommended by researchers at between five to eight degrees vertically from the driver's eye level. Researchers at the Pennsylvania Transportation Institute have adopted the five degree vertical limit as a conservative estimate of sign height limits, or vertical offset. Since additional research into this aspect of sign detection clearly remains to be done, particularly since sign height is affected not only by the viewer's eye position, but by differences in the topography of the roadside itself, the five degree height limit proposed by the PTI research team is offered here only as a minimum guideline for the vertical placement of roadside signs, and not as a USSC standard at this time.

Nonetheless, it can serve to provide some means for optimizing the relationship between sign height, sign detection over both long and short ranges, and motorist safety. Using five degrees of vertical elevation, plus 3.5 feet representing elevation of the average driver's eye position above the road, a calculation of vertical sign height limits capable of providing comfortable detection over both long and short ranges can be derived from the following equation in which:

H equals sign height limit.

D equals distance in feet from the sign at initial detection.

$$H = D(.088) + 3.5$$

Thus, if initial detection distance from the sign is 400 feet, the sign height would be limited to 38.5 feet.

Table 1 below indicates varied Lateral and Vertical Offsets for selected detection ranges.

Detection Distance To Sign	Lateral Offset (Setback)	Vertical Offset (Height Limit)
200 ft.	35 ft.	21 ft.
400 ft.	70 ft.	38.5 ft.
600 ft.	106 ft.	55.5 ft.
800 ft.	141 ft.	73.5 ft.
1000 ft.	176 ft.	90.5 ft.

Lateral Offset at 10 degrees right or left.

Vertical Offset at 5 degrees plus 3.5 feet.

Table 1. Lateral and Vertical Offsets as function of distance.

Detection...Conclusion

The USSC Best Practices Standards for sign legibility and size assumes that conditions of sign orientation and setback afford optimum detectability, as described above. In practice, these conditions would include most freestanding and projecting signs, building signs on walls directly facing the viewer, and roof signs mounted at similar optimum viewing angles within the cone of vision.

Detection as a component of Viewer Reaction Time in the USSC standard is calculated at one-half to one second duration, depending on roadside complexity and traffic volume.

The Message Scan / The Re-Orientation Scan

The message depicted on a sign establishes the time frame for the essential component of the viewing process. Short messages and/or simple typography take less time to read and mentally process than long messages and/or cursive or decorative typography.

In this context, it should be noted that on-premise signs frequently contain a variety of messages, which may be displayed in a number of different sizes and font configurations. The USSC standard for sign size is related principally to Primary Messages, or those messages providing essential information relative to the activities conducted on the site (e.g., the name of the activity, the nature of the activity or product available, principal or major occupants of the site, and other information of similar nature). Secondary Messages are usually designed to provide ancillary information concerning product features or to denote secondary occupants of the site, as seen on site directories. While clearly useful to roadside viewers and to the marketing programs of the sign user, secondary messages are considered less important to the immediate transfer of information demanded of signs placed in a high-speed, dynamic roadside environment in which viewing and reaction time is calculated in seconds.

Current research on average reading times indicates that signs displaying four to eight words in simple typography can be comfortably read and comprehended in approximately four seconds, yielding a reading time, or Message Scan, of one-half second per word. Since words in this context are each assumed to contain five letters, this time frame can be further refined to one-tenth of a second per letter, which is the USSC computational standard for the Message Scan. *(Note: Although it is true that sign copy is read by reference to the words comprising the message, USSC elects to achieve greater precision in the* *calculation process by reference to the individual letters making up the words, in order to minimize any potential skewing effect of large or small words.)*

Additionally, symbols, such as directional arrows, or universally recognized logos or icons displayed on the sign, are considered equivalent to one word, or five letters, yielding a reading, or scan time, of one-half second per symbol. Although reading time for universally recognized symbols has been shown to be at least equal to the reading time per word, it is not known to what extent reading time would be increased if unfamiliar symbols or icons were used. Understandably, the viewer would require more time for interpretation and processing if the symbols were not familiar. Therefore, the USSC standard for computation is based on the use of universally recognizable symbols only.

In addition to the reading time, research based on eye-movement studies indicates that motorists feel compelled to glance back at the road for at least one-half second for every two and one-half seconds of reading time. Within complex driving environments, the USSC Best Practices Standards increases this re-orientation with the road from one-half second to one second to account for the heightened difficulty of the driving task incurred by the additional visual demands of reading a sign.

The Driving Maneuver

When a motorist detects a sign indicating a sought-after location, s/he will respond by executing some form of driving maneuver. Depending on the number of lanes of traffic, traffic volume, and complexity of the driving environment, potential reactions may include signaling, deceleration, braking, changing lanes, and turning either right or left to gain access to the desired location.

The time interval needed to complete the driving maneuver may or may not be included in the computation of Viewer Reaction Time, depending on whether or not such maneuver must be made before (pre-sign) or after (post-sign) the sign location is passed. Generally, since on-premise identity signs are designed to mark the specific location of a given business or institutional entity, driving maneuvers necessary for entry into that location must be executed before passing the sign. The driving maneuver component, then, will be included as part of Viewer Reaction Time.

On the other hand, signs containing directional and/or wayfinding information, or other signs (such as projecting signs in crowded cityscapes) not directing ingress to the location of the sign, do not necessarily require any driving maneuver to be made until after the sign is passed. In these instances, the driving maneuver is not incorporated as part of Viewer Reaction Time.

The USSC standard for the Driving Maneuver varies from four to six seconds depending on roadside complexity and traffic volume.

Table 2. Computation of Viewer Reaction Time

Viewer Reaction Time

Computation Relative to Primary Message

	Driving Environment		
Task	Simple	Complex[1]	Multi Lane[2]
Detection	0.5 Second	1 Second	1 Second
Message Scan	0.1 Sec / Letter 0.5 Sec / Symbol	0.1 Sec / Letter 0.5 Sec / Symbol	0.1 Sec / Letter 0.5 Sec / Symbol
Re-Orientation Scan	0.02 Sec / Letter 0.1 Sec / Symbol	0.04 Sec / Letter 0.2 Sec / Symbol	0.04 Sec / Letter 0.2 Sec / Symbol
Maneuver	4 Seconds	5 Seconds	6 Seconds

1. Developed town or city commercial areas. Single or multi-lane travel under 35 mph
2. Developed urban/suburban commercial areas. Multi-lane travel over 35 mph

The computation table above is designed to provide a reasonably accurate assessment of the minimum Viewer Reaction Time for a motorist, with at least the 20/40 visual acuity necessary to maintain a driving license, to view an individual sign. Because of the significant variations that can exist in individual sign design and placement, motorist response, and the roadside environment in which the sign is placed, the table is intended as a guideline only and not as a substitute for actual field observation.

Viewer Reaction Time – Average Standard

Although the computation chart provides a useful guideline for the Viewer Reaction Time ascribed to a particular sign, it can also be used to approximate a broad average for a variety of signs within a particular landscape. This average

Viewer Reaction Time is helpful in preparing sign size limits for a planned development, a community sign system, or a series of highway oriented and/or wayfinding signs, among others. Assuming a message content of six words (30 letters) on a typical sign, the USSC standard Viewer Reaction Time average in simple environments for pre-sign maneuver is 8 seconds; and for post-sign maneuver, 4 seconds. In complex or multi lane environments, the pre-sign maneuver average advances to 10 or 11 seconds, respectively, and the post-sign maneuver average advances to 5 or 6 seconds.
Table 2 below details these average Viewer Reaction Time values through the range of traffic conditions.

Table 3. Average Viewer Reaction Time

Road Conditions	Maneuver	
	Pre Sign	Post Sign
Simple	8 Sec.	4 Sec.
Complex	10 Sec.	5 Sec.
Multi Lane	11 Sec.	5 Sec.

Average Viewer Reaction Time

Viewer Reaction Distance: Converting Time to Distance

Viewer Reaction Distance represents the distance in lineal feet that a viewer will cover at a given rate of speed during the Viewer Reaction Time interval. Essentially, Viewer Reaction Distance represents the same visual dynamic as Viewer Reaction Time, except it is expressed in lineal feet instead of seconds of elapsed time.

Viewer Reaction Distance is essential to the determination of sign legibility and size. The distance between the viewer and the sign at the point of initial detection determines the letter height necessary for the viewer to acquire and understand the message. By converting Viewer Reaction Time to Viewer Reaction Distance, a relatively precise calculation of initial detection distance can be established.

Viewer Reaction Distance, expressed in feet, can be calculated by first converting travel speed in miles per hour (MPH) to feet per second (FPS) by using the multiplier, 1.47.

FPS = (MPH) 1.47

Viewer Reaction Distance (VRD) is then calculated by multiplying feet per second by the Viewer Reaction Time (VRT).

The following is the resultant equation:

VRD = (MPH) (VRT) 1.47

Letter Height / The USSC Standard Legibility Index

The overall legibility of a sign is, essentially, a function of the height, color, and font characteristics of the letters making up its message component. For the publication, *Sign Legibility: The Impact of Color and Illumination*, test track studies of individual signs were conducted, using subjects in all age groups, to determine the effect that different conditions of daylight and darkness have on detecting and reading signs of varying colors. In order to simulate real-world conditions, two letterforms, Helvetica and Clarendon, were chosen for the study, as they best represent the two general letterform families used in the English language: sans-serif Gothic style (Helvetica) and serif Roman style (Clarendon). The research produced a definitive understanding of the legibility of letterforms under many color and illumination conditions, as well as an understanding of the letter heights necessary for legibility over varying distances from the observer.

Figure 2. Helvetica and Clarendon Letterforms

Using this research not only as a benchmark for the specific letterforms studied, but also as a reasonable basis for extrapolation to other similarly configured letterforms, USSC developed a Standard Legibility Index. By means of the Index, the height of letters necessary to provide legibility from a given distance can be calculated.

The USSC Standard Legibility Index is a numerical value representing the distance in feet for every inch of capital letter height at which a sign may be read. The table also reflects the 15 percent increase in letter height required when all upper case letters (all caps) are used instead of upper and lower case letters with initial caps, a difference in recognition distance documented in earlier studies by the researchers at the Pennsylvania Transportation Institute.

To use the table to determine letter height for any given viewing distance, select the combination of illumination, letter style, letter color, and background color that most closely approximates those features on the sign being evaluated. Then, divide the viewing distance (in feet) by the appropriate Legibility Index value. The result is the letter height in inches for the initial capital letter in upper and lower case configurations, or for every letter in an all caps configuration.

$$\text{Letter Height} = \frac{\text{VRD}}{\text{Legibility Index}}$$

Letter height is expressed in inches, and the Viewer Reaction Distance (VRD) in feet.

Table 4. The USSC Standard Legibility Index

ILLUMINATION	LETTER STYLE	LETTER COLOR	Background COLOR	LEGIBILITY INDEX Upper & Lower Case	LEGIBILITY INDEX ALL CAPS
External	Helvetica	Black	White	29	25
External	Helvetica	Yellow	Green	26	22
External	Helvetica	White	Black	26	22
External	Clarendon	Black	White	28	24
External	Clarendon	Yellow	Green	31	26
External	Clarendon	White	Black	24	20
Internal Translucent	Helvetica	Black	White	29	25
Internal Translucent	Helvetica	Yellow	Green	37	31
Internal Translucent	Clarendon	Black	White	31	26
Internal Translucent	Clarendon	Yellow	Green	37	31
Internal Opaque	Helvetica	White	Black	34	29
Internal Opaque	Helvetica	Yellow	Green	37	31
Internal Opaque	Clarendon	White	Black	36	30
Internal Opaque	Clarendon	Yellow	Green	37	28
Neon	Helvetica	Red	Black	29	25
Neon	Helvetica	White	Black	38	32

Illumination Variations:

External light source

Internal light source with fully translucent background

Internal light source with translucent letters and opaque background

Exposed neon tube

Legibility Index – Average Standard

30

In addition to the specific legibility ranges provided by the chart, an average Legibility Index value can be used in some situations. For instance, if a committee wishes to set code limits for average size ranges for a community sign system, or to set letter height and size limits for a highway or community wayfinding system, an average Legibility Index value of 30 may be used. However, it must be understood that this is an average only and, as such, may fall short of meeting the legibility needs of any specific sign or environment.

Legibility Index – Environmental Adjustment

In *Real World On-Premise Sign Visibility, The Impact of the Driving Task on Sign Detection and Legibility* (Pennsylvania Transportation Institute 2002), a marked difference was documented between legibility index results obtained from the relatively distraction free test track environment (as detailed in table 4), and observations taken from real-world driving situations involving increased levels of driver workload in complex and/or congested environments.

Both the research team at PTI, as well as a similar team studying the impact of the driving task on sign legibility (Chrysler, et al. 2001), arrived at the same essential conclusion; notably that the driving task, particularly in environments involving a high degree of visual stimuli, produces a significant reduction in the basic test track legibility index values.

This reduction, or legibility index deterioration, is essentially a manifestation of delayed detection caused by increased driver workload, and is clearly measurable as a percentage decrease in the standard legibility index. In a comparison analysis of the test track values versus values produced from real world observation, an average decrease of at least thirty-five percent of the standard legibility index values was documented, with extreme values as low as seven feet of distance per inch of letter height in highly complex environments. In general, and across a median range of complexity, this decrease can conservatively result in a reduction in the average legibility index value of 30 feet of distance per inch of letter height to 20 feet of distance per inch of letter height, particularly as the complexity of the driver's visual load is increased.

Accordingly, in both moderate to highly congested zones in which demands on driver attention are high, USSC recommends the application of an adjustment factor designed to bring the standard legibility index values into alignment with the real world driving conditions encountered by drivers in those zones. The adjustment factor is applied by multiplying the standard legibility index value by the adjustment factor. The product is the adjusted legibility index for the zone.

Adjustment Factors:

1). For moderately congested strip, in-town, or in-city zones, usually characterized by some of the following environmental conditions:

Moderate pedestrian and/or vehicular activity
Traffic signal or traffic sign control at major intersections
Intermittent "stop and go" traffic patterns
On street Parking
Posted speeds below 40 MPH
Tightly spaced retail locations

Apply Adjustment Factor of 0.83

Or as an equation; Adjusted Moderate Complexity LI = (Standard LI) 0.83

Thus, in moderately congested zones, the average legibility index value of 30 would be adjusted to 25, and individual index values adjusted accordingly. In highly congested zones, (as characterized in 2 below) the average legibility index value would be adjusted from 30 to 20 feet/inch.

2). For highly congested strip, in-town, or in-city zones
usually characterized by some of the following environmental conditions:

- High pedestrian and/or vehicular activity
- Traffic signal or traffic sign control at most intersections
- Intermittent "stop and go" traffic patterns
- On street parking
- Posted speeds below 30 MPH
- Tightly spaced retail locations

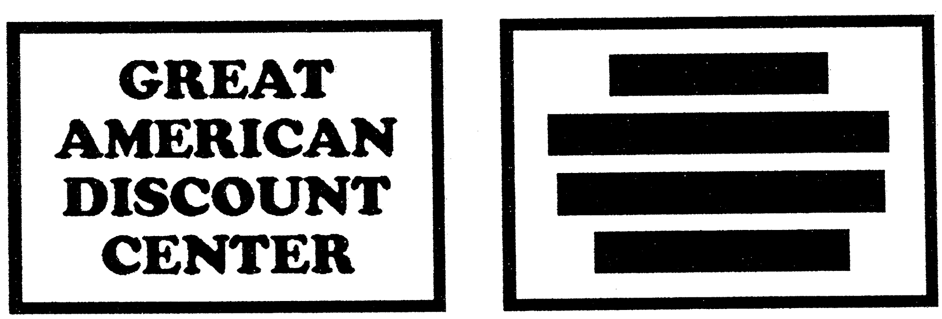
Apply Adjustment Factor of 0.67

Or as an equation; Adjusted High Complexity LI = (Standard LI) 0.67

Copy Area

The copy area of a sign is that portion of the sign face encompassing the lettering and the space between the letters (letterspace), as well as any symbols, illustrations, or other graphic elements. It is a critical component of effective sign design because it establishes the relationship between the message and the negative space necessary to provide the sign with reasonable legibility over distance.

Figure 3. Copy Area

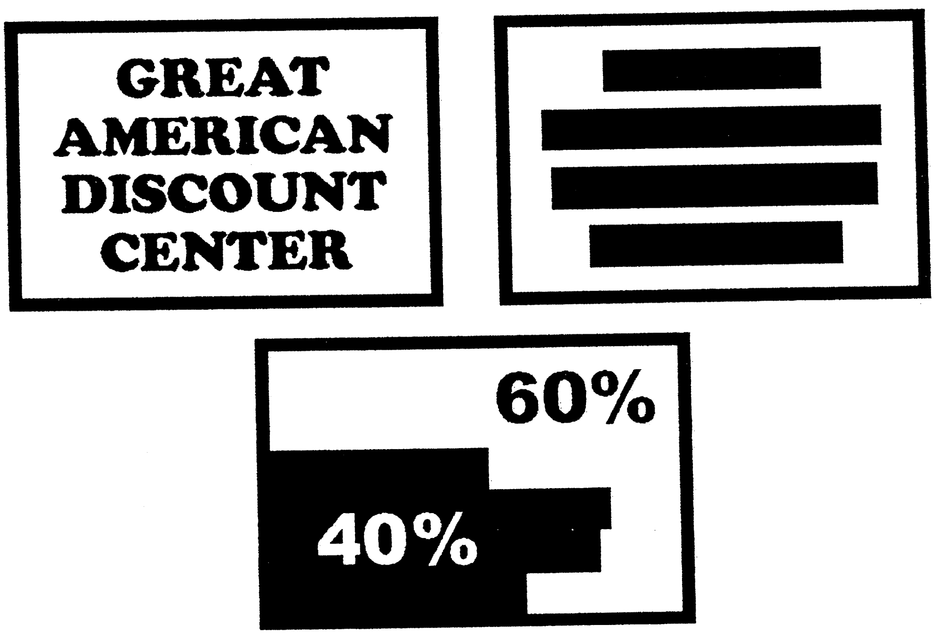


The illustration on the left depicts a typical on-premise sign face; while the one on the right, with black rectangles covering the copy area, affords a visual of the message layout

Negative Space

Negative space is the open space surrounding the copy area of a sign. It is essential to legibility, particularly in signs in which the copy is displayed within a background panel. Negative space ideally should not be less than 60 percent of the sign or background area. This requirement for a 40/60 relationship between the copy area and negative space is the minimum USSC standard. It is intended only to establish a measurable baseline for the negative space component of a sign, such that a reasonable expectation of legibility will exist.

Figure 4. Relationship Between Copy Area And Negative Space



The bottom sign panel illustrates how the aggregate copy area comprises 40 percent of the total sign panel area, with the remaining 60 percent forming the negative space area.

DETERMINING SIGN SIZE – Calculation Methodology

The size of a sign is determined by the size and length of the message and the time required to read and understand it. It can be calculated once the numerical values of the five size determinants –Viewer Reaction Time, Viewer Reaction Distance, Letter Height, Copy Area, and Negative Space – have been established.

The step-by-step process to determine sign size, which is explained below, is useful not only as a calculation method, but also as a means of understanding the elements involved in the calculation.

Area of Sign / Computation Process:

1. Determine speed of travel (MPH) in feet per second (FPS): (MPH x 1.47).
2. Determine Viewer Reaction Time (VRT).
3. Determine Viewer Reaction Distance (VRT x FPS).
4. Determine Letter Height in inches by reference to the Legibility Index (LI): (VRD/LI).
5. Determine Single Letter Area in square inches (square the letter height to obtain area occupied by single letter and its adjoining letterspace).
6. Determine Single Letter Area in square feet: Single Letter Area in square inches/144.
7. Determine Copy Area (Single Letter Area in square feet x total number of letters plus area of any symbols in square feet).
8. Determine Negative Space Area at 60% of Sign Area (Copy Area x 1.5).
9. Add Copy Area to Negative Space Area.
10. Result is Area of Sign in square feet.

Computation Process / Calculation Example

Figure 5. Calculation Example Sign

Location: Complex Driving Environment

Posted Traffic Speed of 40 MPH

Sign Background: White

Sign Copy: 23 Letters, Upper & Lower Case

Clarendon Style, Black

Internally Illuminated, Translucent Face

1. Determine speed of travel in feet per second; 40 MPH x 1.47 = 59 FPS
2. Determine Viewer Reaction Time - Refer to Table 2
   Detection (Complex Environment) .... 1 second
   Message Scan - 23 letters x 0.1.................2.3 seconds
   Re-orientation Scan - 23 letters x .04.........0.9 seconds
   Maneuver...5 seconds
   Total Viewer Reaction Time (rounded) = 9 seconds VRT
3. Determine Viewer Reaction Distance; 59 (FPS) x 9 (VRT) = 530 feet
4. Determine Letter Height in inches - Refer to Legibility Index, Table 4
   Black Clarendon letters on White background = Index of 31
   530 (VRD) / 31 (LI) = 17 inch letter height
5. Determine Single Letter Area in square inches
   17 x 17 = 289 square inches, single letter area
6. Determine Single Letter Area in square feet
   289 / 144 = 2 square feet, single letter area
7. Determine Copy Area; single letter area (sq. ft.) x number of letters
   2 x 23 = 46 square feet, copy area
8. Determine Negative Space @ 60% of sign area
   46 x 1.5 = 69 square feet, negative space
9. Add Copy Area to Negative Space
   46 + 69 = 115 square feet
10. Result is Area of Sign, 115 square feet

Area of Sign – Equation / Specific Usage

In addition to the computation method above, the USSC has developed an algebraic equation to determine the Area (A_{sign}) for signs containing letters only, which will provide the same result but will simplify the process. The equation allows for insertion of all of the size determinants, except for Negative Space, which is fixed at the standard 40/60 ratios. (Note: If numbers are rounded off in the computation process, a very slight difference in result may occur between the computation process and the equation).

$$A_{sign} = \frac{3n}{80}\left[\frac{(VRT)\,(MPH)}{LI}\right]^2$$

Fixed Value:
- 40/60 ratio, letters/negative space

Variable Values:
- Number of Letters (n)
- Viewer Reaction Time (VRT)
- Miles Per Hour (MPH)
- Legibility Index (LI)

Area of Sign – Equation / Broad Usage

The equation above is used to calculate the size of a sign containing letterforms when the motorist is traveling at a specific rate of speed. To allow for a broader scientific evaluation of sign size and satisfy the minimal legibility requirements across a full range of reaction times and speed zones, USSC has developed a second equation. This formula fixes the average sign size determinants, leaving only Viewer Reaction Time (VRT) and the speed of travel (MPH) as the sole variables. It can be used to ascertain the general size of signs necessary to adequately and safely convey roadside information to motorists traveling at a given rate of speed as well as to establish size parameters for signs across an entire community and/or road system. Table 5 below provides some examples of the use of the equation.

$$A_{sign} = \frac{[(VRT)\,(MPH)]^2}{800}$$

Fixed Values:
- 30 Letters
- Legibility Index (LI) of 30
- 40/60 ratio, letters/negative space

Variable Values:
- Viewer Reaction Time (VRT)
- Miles Per Hour (MPH)

Table 5. Sign Size As Function Of Travel Speed And Viewer Reaction Time

MPH	VRT (Seconds)	Sign Size (Square Feet)
25	4	12.5
	5	20
	8	50
	10	78
40	4	32
	5	50
	8	128
	10	200
55	4	60.5
	5	95
	8	242
	10	378

Sign Size as function of travel speed and Viewer Reaction Time

Sign Height – Minimum Standards for Vehicular Oriented Environments

For signs providing roadside information in primarily vehicular-oriented environments, the height above grade of the sign and/or sign copy has a pronounced effect on an approaching motorist's ability to detect and read the message displayed. As is now documented in the research publication, *Sign Visibility, Effects of Traffic Characteristics and Mounting Height*, the simple presence of other vehicles on the road (i.e., in front, in an adjacent travel lane, or in travel lanes in the opposite direction) can potentially prevent the motorist from detecting a sign. If a sign is situated at or below five feet above grade, other vehicles may block the motorist's view, and the sign copy will not be legible.

The aforementioned study used analytical algorithms reflecting known patterns of traffic flow and volume, in conjunction with computer generated simulation software. The research resulted in predictions of the percentage of times that other vehicles blocked the view of an approaching motorist, thus preventing him/her from detecting a low mounted sign (5 feet or less above grade). The percent of blockage was computed as a function of the traffic flow rate, the position of the subject motorist in the traffic stream, and the position and setback of the sign. Oversize vehicles (such as trucks, buses, and recreational vehicles) were not included in the calculations even though their normal presence in the vehicular mix would have, undoubtedly, increased the percentages noted in the study.

Eight traffic scenarios were analyzed, based on a four-lane undivided highway and either 35 or 45 miles per hour as the speed of travel. These conditions were chosen to simulate the general characteristics of roadways traversing commercial zones throughout the United States. The signs (assumed to be 10 feet wide) were located at either 10 or 20 feet from the edge of the roadway and on either the right- or left-hand side of the road. The findings clearly establish a quantifiable loss of visibility across the full range of sign placement as traffic flow rates increase. The charts, A through H, document the findings for traffic flow rates ranging from 200 to 1200 vehicles per hour.

Based on the research, the USSC minimum height standard for copy on signs placed on roads with characteristics as detailed in the charts is no less than five feet above grade. However, the USSC strongly recommends a minimum height standard for sign copy of no less than seven feet above grade in order to ensure adequate visibility and a reasonable viewer reaction time, considering the blocking potential of other vehicles on the road. The seven feet above grade recommendation is the same as the Federal Highway Administration's standard, as promulgated in the Manual of Uniform Traffic Control Devices (MUTCD), for the height above grade of official roadside directional and wayfinding signs utilized along urban roadways in the United States.

Minimum Sign Height – Regulatory Issues

As a related issue, the visibility requirement for ground or monument sign copy placement above seven feet above grade may run counter to community sign code regulation which: 1.) sets overall low maximum height limits, or 2.) computes maximum square footage limits on sign size as the simple product of the total height times the total width of the monument structure, regardless of sign copy placement. In either case, a community intent on encouraging the use of monument or monolithic type ground signs may find its sign regulations to be counter productive to its aims, as well as to the effective transfer of roadside information in moderate to high density traffic conditions.

To alleviate this condition, USSC offers the following sign code modification recommendations for use in land use zones in which the data indicate significant blockage of the copy area of low mounted or monument signs.

1.) Maximum height limits of such signs – as well as maximum height limits for other freestanding signs within the zone – should take into account the recommended lower limit of seven feet above grade for copy placement.
2.) No maximum square footage assessment of monument or monolithic type ground signs should be imposed below seven feet above grade, provided that no primary copy is placed within that area. See Figure 6 below.

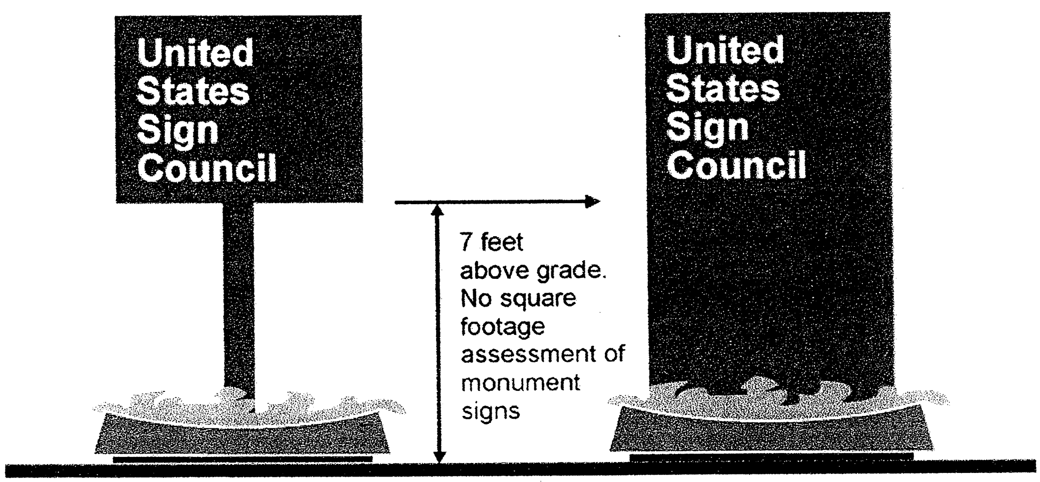


Figure 6. Comparison / Pole and Monument Signs

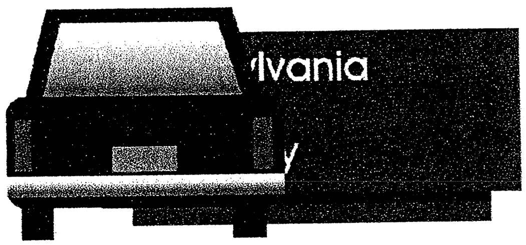
Sign Blocking Scenarios (Schematic)

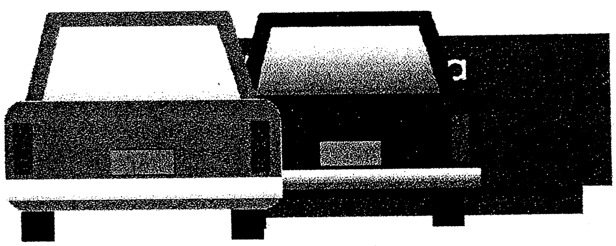
Sign Blocking Charts (Schematic)
Blocking Tables

Sign Blocking Scenarios (Schematic)

Typical
Low Mounted
Ground Sign

Single Lane
View
Blocking





Two Lane
View
Blocking

Visibility
Solution:
Maintain Sign
Design Style
Raise Copy
To Viewable Height

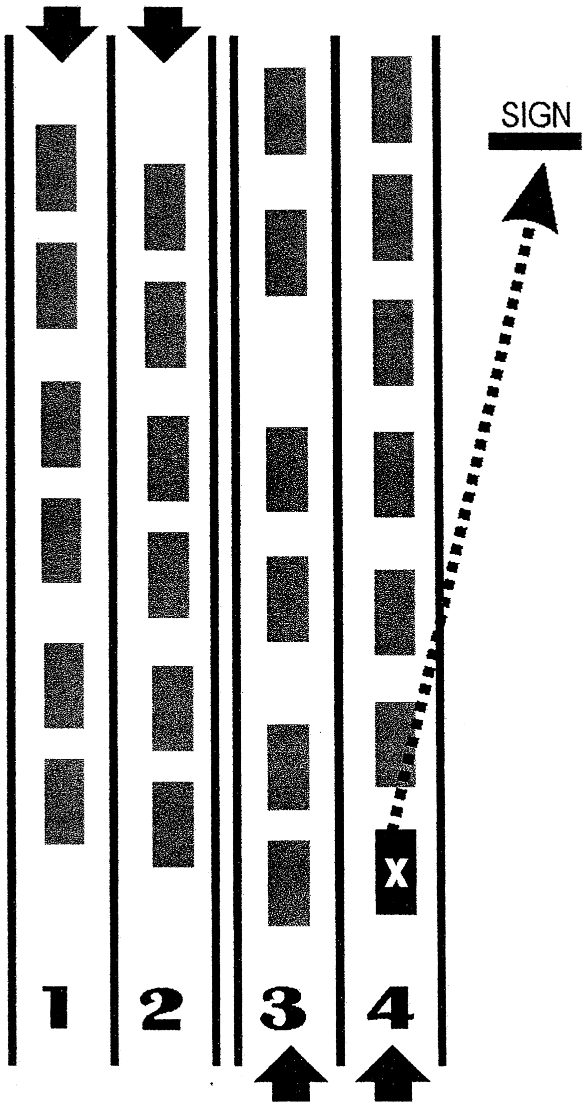


Chart A
(Schematic)

Speed of Travel

35 mph

Subject Vehicle - Lane 4
Sign on Right

Tables indicate percent of time sign is blocked from view of subject vehicle depending on Flow Rate and sign setback.

Flow Rate represents the number of vehicles traveling in both lanes in one direction for a period of one hour.

Sign Setback at 10 Feet

Flow Rate	% Blocking
200	9
400	17
600	25
800	31
1000	38
1200	43

Sign Setback at 20 Feet

Flow Rate	% Blocking
200	6
400	12
600	18
800	23
1000	28
1200	33

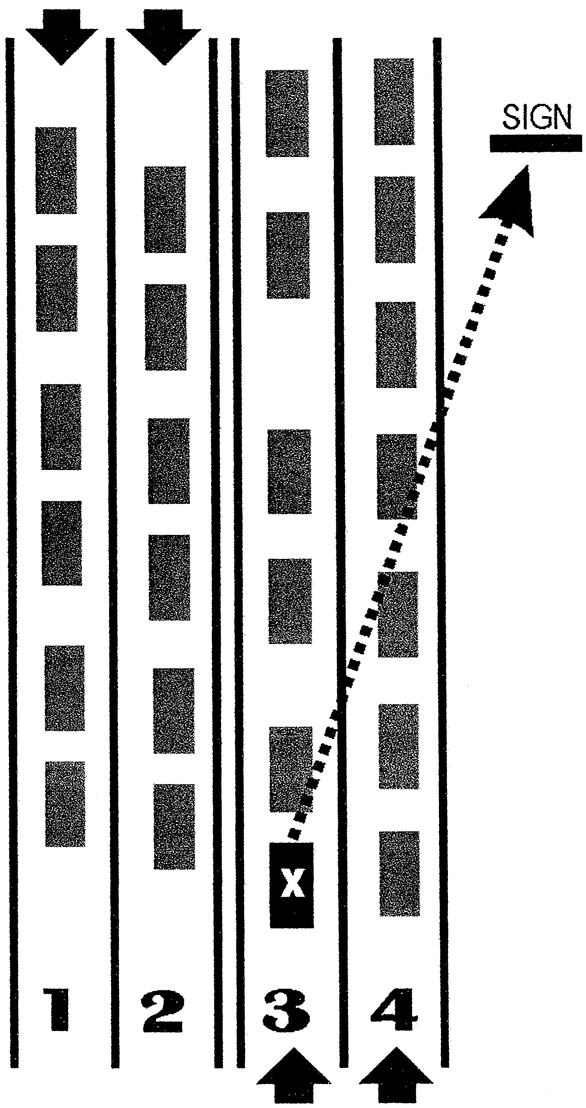


Chart B

(Schematic)

Speed of Travel

35 mph

Subject Vehicle - Lane 3
Sign on Right

Tables indicate percent of time sign is blocked from view of subject vehicle depending on Flow Rate and sign setback.

Flow Rate represents the number of vehicles traveling in both lanes in one direction for a period of one hour.

Sign Setback at 10 Feet

Flow Rate	% Blocking
200	16
400	29
600	41
800	50
1000	58
1200	65

Sign Setback at 20 Feet

Flow Rate	% Blocking
200	12
400	24
600	33
800	42
1000	49
1200	56

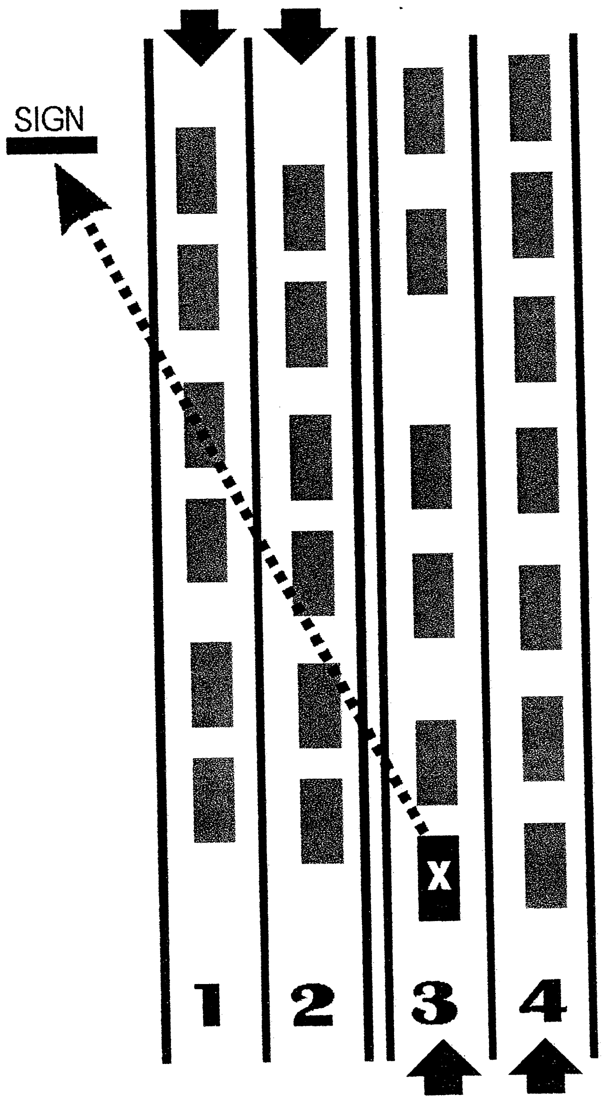


Chart C

(Schematic)

Speed of Travel

35 mph

Subject Vehicle - Lane 3
Sign on Left

Tables indicate percent of time sign is blocked from view of subject vehicle depending on Flow Rate and sign setback.

Flow Rate represents the number of vehicles traveling in both lanes in one direction for a period of one hour.

Sign Setback at 10 Feet

Flow Rate	% Blocking
200	19
400	35
600	48
800	58
1000	66
1200	72

Sign Setback at 20 Feet

Flow Rate	% Blocking
200	16
400	30
600	41
800	51
1000	59
1200	65

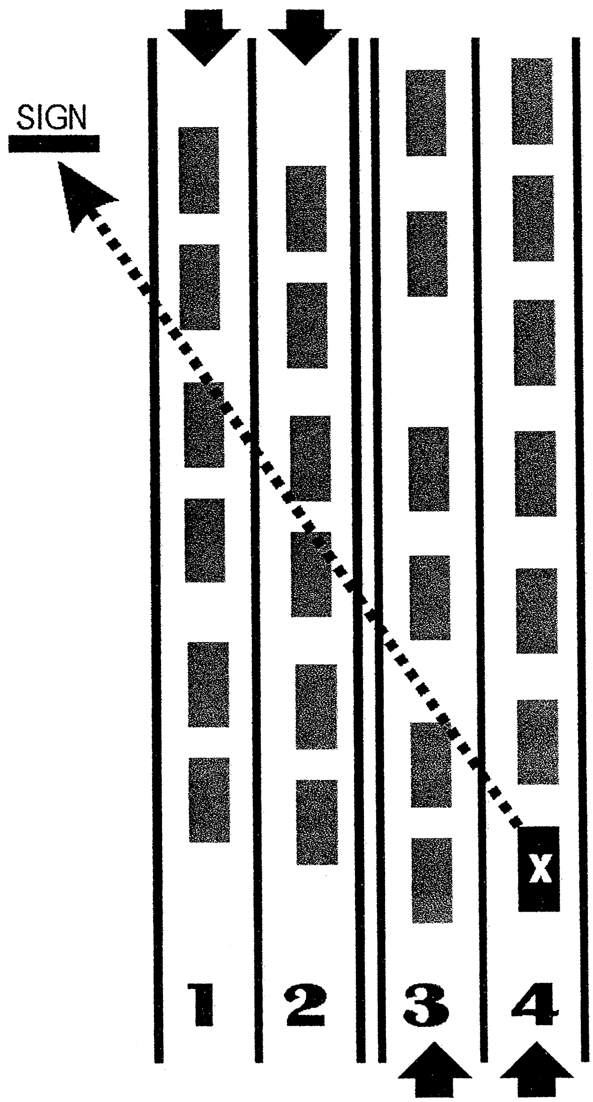


Chart D

(Schematic)

Speed of Travel

35 mph

Subject Vehicle - Lane 4
Sign on Left

Tables indicate percent of time sign is blocked from view of subject vehicle depending on Flow Rate and sign setback.

Flow Rate represents the number of vehicles traveling in both lanes in one direction for a period of one hour.

Sign Setback at 10 Feet

Flow Rate	% Blocking
200	23
400	41
600	54
800	65
1000	73
1200	79

Sign Setback at 20 Feet

Flow Rate	% Blocking
200	20
400	36
600	49
800	59
1000	67
1200	74

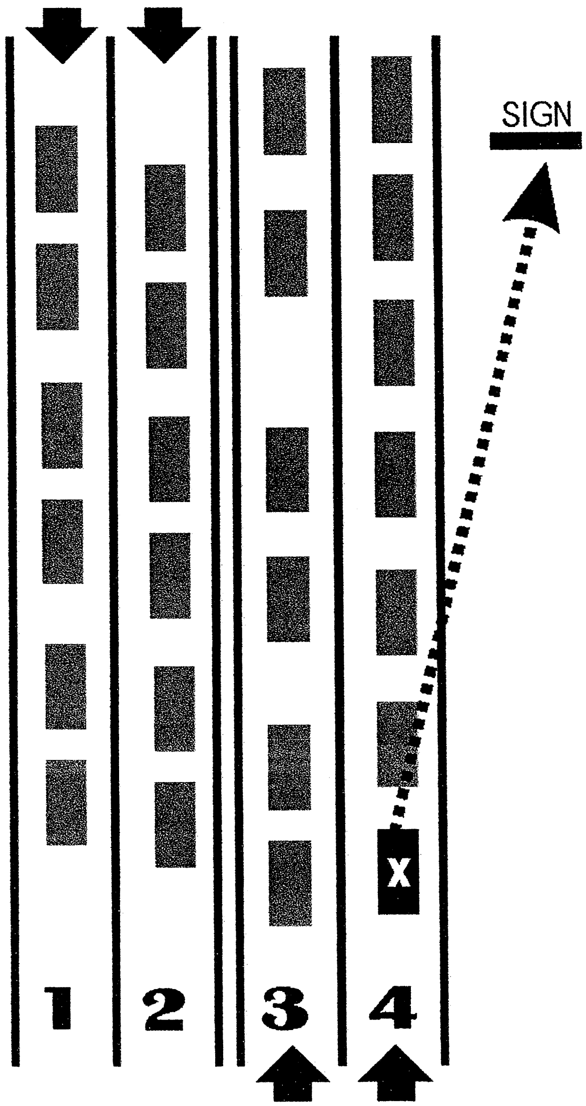


Chart E

(Schematic)

Speed of Travel

45 mph

Subject Vehicle - Lane 4
Sign on Right

Tables indicate percent of time sign is blocked from view of subject vehicle depending on Flow Rate and sign setback.

Flow Rate represents the number of vehicles traveling in both lanes in one direction for a period of one hour.

Sign Setback at 10 Feet

Flow Rate	% Blocking
200	9
400	17
600	24
800	31
1000	37
1200	42

Sign Setback at 20 Feet

Flow Rate	% Blocking
200	6
400	12
600	17
800	23
1000	27
1200	32

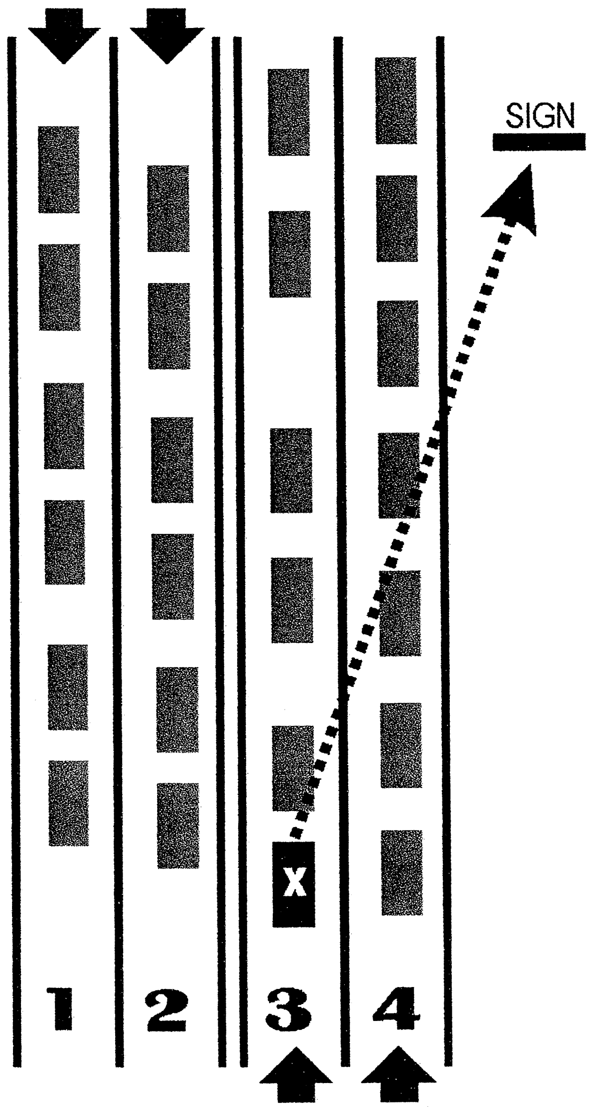


Chart F

(Schematic)

Speed of Travel

45 mph

Subject Vehicle - Lane 3
Sign on Right

Tables indicate percent of time sign is blocked from view of subject vehicle depending on Flow Rate and sign setback.

Flow Rate represents the number of vehicles traveling in both lanes in one direction for a period of one hour.

Sign Setback at 10 Feet

Flow Rate	% Blocking
200	16
400	29
600	40
800	49
1000	57
1200	64

Sign Setback at 20 Feet

Flow Rate	% Blocking
200	12
400	23
600	32
800	41
1000	48
1200	54

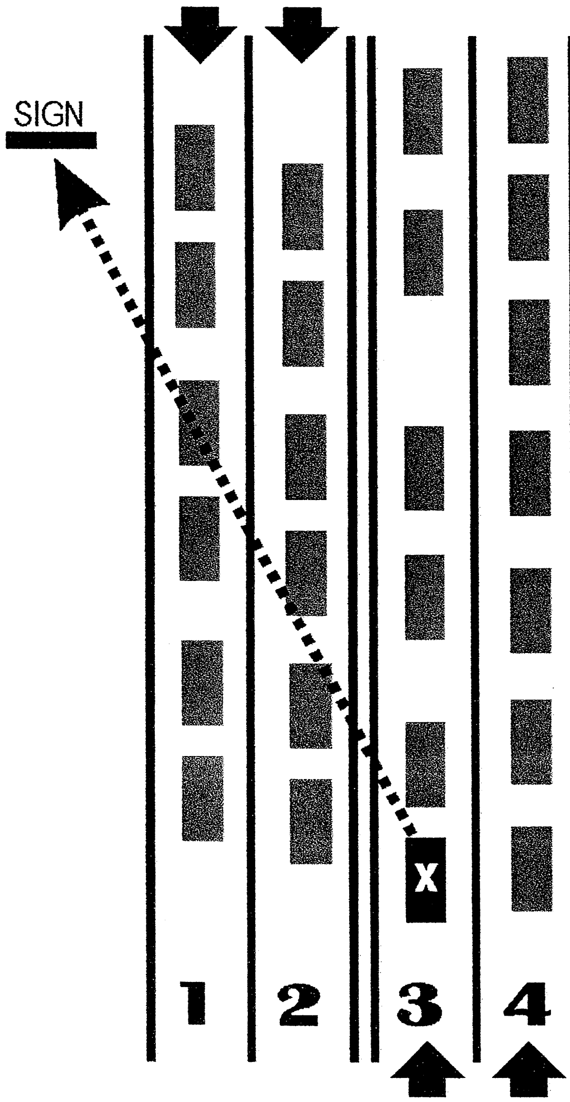


Chart G
(Schematic)

Speed of Travel

45 mph

Subject Vehicle - Lane 3
Sign on Left

Tables indicate percent of time sign is blocked from view of subject vehicle depending on Flow Rate and sign setback.

Flow Rate represents the number of vehicles traveling in both lanes in one direction for a period of one hour.

Sign Setback at 10 Feet

Flow Rate	% Blocking
200	19
400	34
600	46
800	56
1000	64
1200	70

Sign Setback at 20 Feet

Flow Rate	% Blocking
200	16
400	29
600	40
800	49
1000	57
1200	63

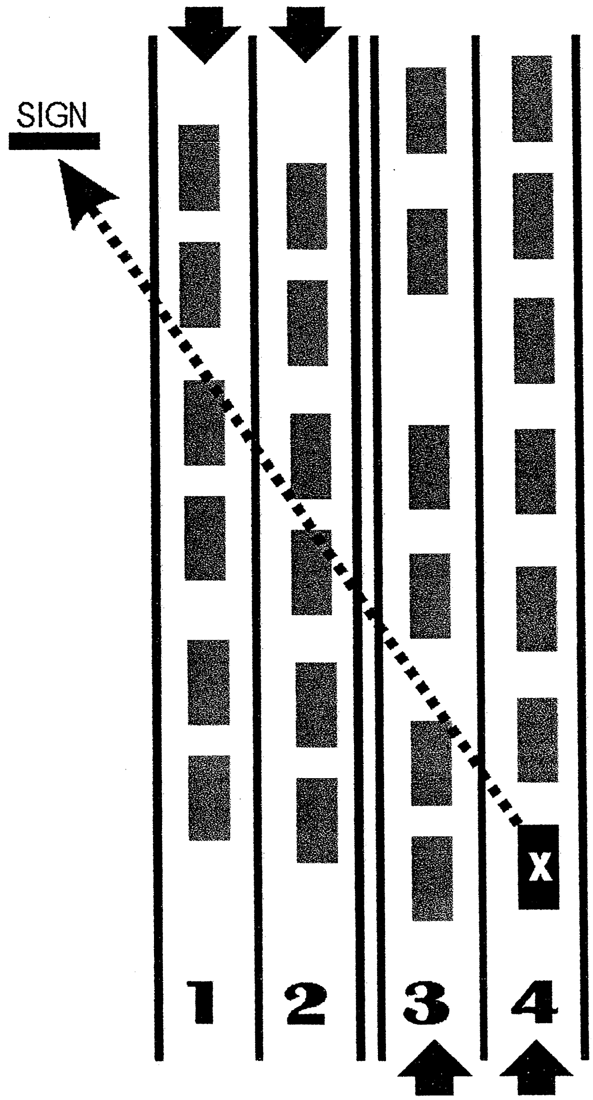


Chart H
(Schematic)

Speed of Travel

45 mph

Subject Vehicle - Lane 4
Sign on Left

Tables indicate percent of time sign is blocked from view of subject vehicle depending on Flow Rate and sign setback.

Flow Rate represents the number of vehicles traveling in both lanes in one direction for a period of one hour.

Sign Setback at 10 Feet

Flow Rate	% Blocking
200	22
400	39
600	52
800	63
1000	71
1200	77

Sign Setback at 20 Feet

Flow Rate	% Blocking
200	19
400	34
600	47
800	57
1000	65
1200	71

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Attachment F

On-Premise Signs

Determination of Parallel Sign Legibility and Letter Heights

UNITED STATES SIGN COUNCIL

RESEARCH CONCLUSIONS / PENNSYLVANIA STATE UNIVERSITY

ON-PREMISE SIGNS
Determination of Parallel Sign Legibility and Letter Heights

A Research Project Of The
UNITED STATES SIGN COUNCIL FOUNDATION

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Abstract

The USSCF has published research-based legibility tables to help the signage community determine appropriate on-premise commercial sign letter heights. These indices were developed to ensure adequate readability of signs that are mounted *perpendicular* to the roadway. On-premise signs however, are often oriented *parallel* to the driver's line of sight (for example, wall signs) and this type of sign is more difficult to read.

This document describes the development of, and rationale for, a mathematical model that calculates letter heights for parallel-mounted on-premise commercial signs. This model can be applied to the current USSCF legibility standards so that the letter heights developed for perpendicular signs form the basis for letter heights on parallel signs with various lateral offsets. A letter height lookup table is provided for many typical parallel sign scenarios.

Background

In 1998, the United States Sign Council Foundation (USSCF) published a research-based legibility table to help the signage community determine appropriate on-premise commercial sign letter heights (Table 1). The legibility indices in that table were developed to ensure adequate readability of projecting and free-standing signs that are mounted *perpendicular* to the roadway (Figure 1). On-premise wall signs however, are often oriented *parallel* to the driver's line of sight (Figure 2). Everyday experience teaches us that parallel signs are more difficult to read, and research conducted for the USSCF corroborates those subjective impressions with scientific evidence (Zineddin, Garvey, and Pietrucha, 2005).

Table 1. USSCF Legibility Index Table.

ILLUMINATION	LETTER STYLE	LETTER COLOR	Background COLOR	LEGIBILITY INDEX	
				Upper & Lower Case	ALL CAPS
External	Helvetica	Black	White	**29**	**25**
External	Helvetica	Yellow	Green	**26**	**22**
External	Helvetica	White	Black	**26**	**22**
External	Clarendon	Black	White	**28**	**24**
External	Clarendon	Yellow	Green	**31**	**26**
External	Clarendon	White	Black	**24**	**20**
Internal Translucent	Helvetica	Black	White	**29**	**25**
Internal Translucent	Helvetica	Yellow	Green	**37**	**31**
Internal Translucent	Clarendon	Black	White	**31**	**26**
Internal Translucent	Clarendon	Yellow	Green	**37**	**31**
Internal Opaque	Helvetica	White	Black	**37**	**29**
Internal Opaque	Helvetica	Yellow	Green	**36**	**31**
Internal Opaque	Clarendon	White	Black	**34**	**30**
Internal Opaque	Clarendon	Yellow	Green	**37**	**28**
Neon	Helvetica	Red	Black	**29**	**25**
Neon	Helvetica	White	Black	**38**	**32**

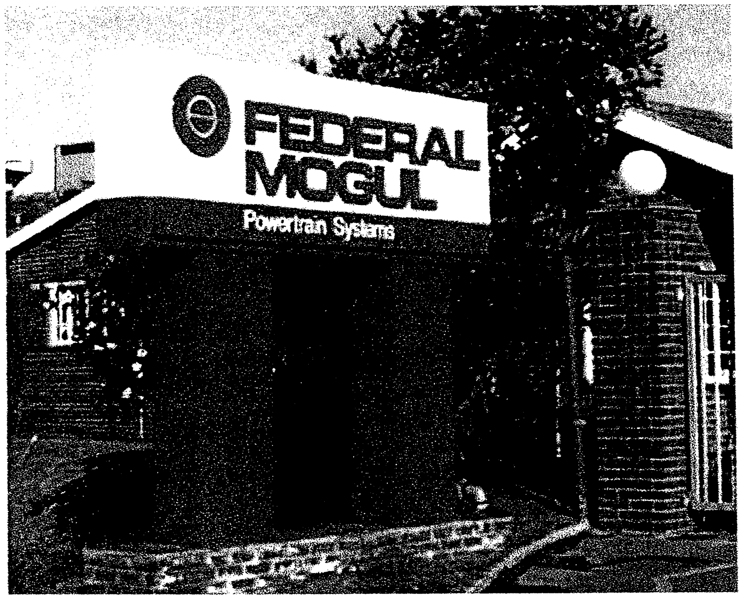

Figure 1. Perpendicular on-premise freestanding sign.

Figure 2. Parallel on-premise wall sign.

A parallel sign is harder to read because its orientation, or tilt, with respect to the driver makes it impossible to see the sign face at certain distances and offsets (Figure 3). When the driver *can* see the sign face, the content is often foreshortened and distorted. The driver must get close to the sign in order to increase the viewing angle to the point where the sign becomes legible. However, as drivers approach the sign, the time they have to read it gets shorter, while the sign moves further into their peripheral vision. Therefore, parallel signs must be read using a series of very quick glances at large visual angles during small windows of opportunity. Because of this, the letter heights developed for perpendicular signs, where drivers have more time and can take longer straight ahead glances, will not provide adequate parallel sign legibility.

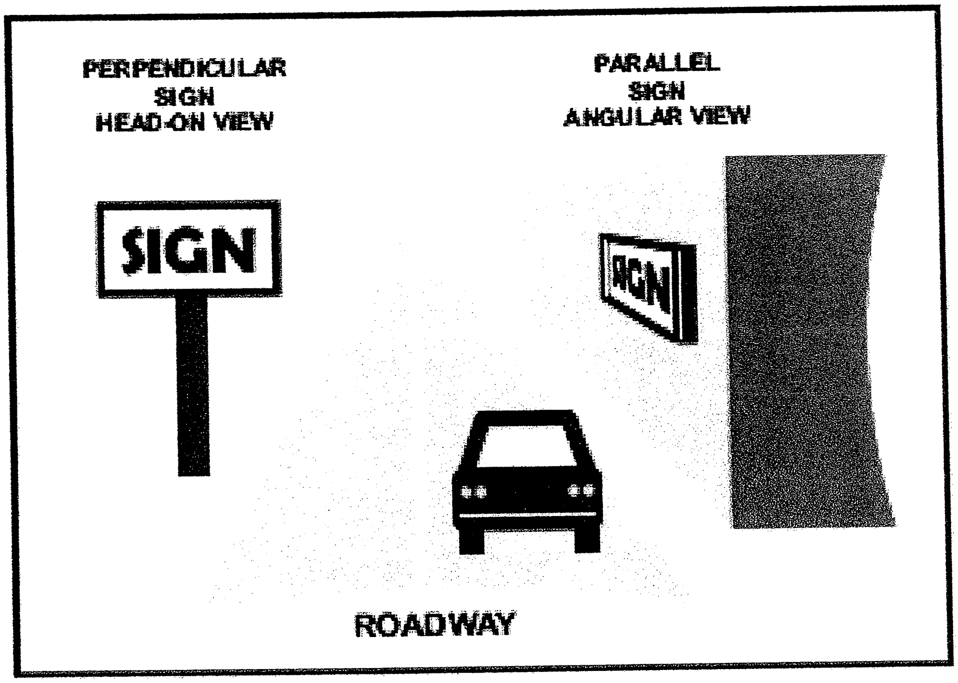

Figure 3. Observation angle determines relative legibility

Objective

The objective of this study was to develop a simple mathematical model to determine appropriate parallel-mounted on-premise commercial sign letter heights. Using that model, a lookup table was constructed to provide users with ready access to parallel sign letter heights for a typical sign at representative roadway cross-sections (number of lanes) and lateral sign offsets. Two simple equations are also provided: one for users with atypical offsets, and the other to be combined with Table 1 for users who have detailed information about sign characteristics such as typeface and lighting design.

A literature review was conducted, and the results of past research in applied eye tracking and applied and basic reading speed were used to provide specific input into the model and to support its general validity. Several components were considered in developing the model:

1. Glance Angle: The maximum angle drivers look away from the road to read signs.
2. Glance Duration: The length of time drivers look away from the road to read signs.
3. Glance Frequency: The number of glances that drivers make at any given sign.
4. Sign reading speed.
5. Observation Angle: The angle, or tilt, at which signs become legible.
6. Lateral sign offset.
7. Vehicle travel speed.

Literature Review

Glance Angle

It is well known that target detectability is poor for signs located away from the center of the driver's visual field. For example, Claus and Claus (1975) stated that signs should be placed within 30 degrees of the driver's line of sight, and Jenkins and Cole (1986) wrote, "If a sign is to be noticed . . . it will be within 10 degrees of his line of sight." These studies illustrate how difficult it is to passively detect signs with large lateral offsets. Other research indicates that the vast majority of active scanning behavior is also in a very small cone of vision located straight ahead of the driver.

While no studies have evaluated how far to the left or right drivers are willing to look for on-premise signs, several researchers have assessed driver eye scanning in the presence of outdoor advertising (i.e., billboards). In 2003, Beijer evaluated driver glances toward outdoor advertising signs and found that the average lateral glance angle (how far from straight ahead the drivers looked) was only 9°. Although he did find instances where the driver looked as far off as 75° degrees, 80 percent of glances were within 10° of center and 98 percent were within 25°.

In 2004, Smiley and her colleagues studied the impact of video advertising on driver fixation patterns and found that in the presence of large electronic message centers (EMCs), 76 percent of glances were straight ahead at traffic, seven percent were at street name signs, six percent at pedestrians, and only 1.5 percent at the advertising signs. Similar to Beijer's results, Smiley's research found that 69 percent of glances were within 15° of straight ahead and 77 percent were within 20°. The maximum horizontal angle was smaller than Beijer's at only 31°.

Glance Duration

One of the main hypotheses behind the parallel sign letter height model developed for this project was that these signs must be read in a small fraction of a second. Therefore, determining the length of time that drivers look away from the road to read signs was critical. Some researchers suggest that two seconds is the maximum time drivers are typically willing to look away from the road for any reason (e.g., Smiley, et al., 2004). Beijer (2003) reviewed the literature on driver eye movement and reported evidence for "spare visual capacity" during driving that would allow for safe non-driving related glances of slightly greater than one second. A review of the research however, shows that drivers typically use much shorter "look away" times to read signs.

Serafin (1994) reviewed the highway literature and found that glance duration was about 600 ms on average for any road feature (one millisecond (ms) = 1/1000 of a second; 500 ms is ½ second). In her own research, Serafin found average glance durations at roadway features to be shorter than this, about 158 ms, with younger drivers having slightly longer durations (174 ms) than older drivers (145 ms). Mourant, et al. (1969) found glance duration for road signs to be about 1/3 second, while Zwahlen (1987 and 1988) found average glance duration to vary depending on sign type: stop ahead signs 650-820 ms; stop signs 370-660 ms; curve signs (with advisory) 580-610 and without advisory 510-580 ms.

In Beijer's (2003) research on outdoor advertising signs, he found average glance duration to be about 500 ms with a minimum of 130 ms and a maximum of 2.07 seconds. His research also showed that only 22 percent of glances were longer than ¾ of a second. Smiley, et al. (2004) found glance duration for EMC's to average 480 ms with a maximum of 1.47 seconds.

Although one would expect glance duration to be inversely related to glance angle, no research was found that evaluated this relationship. In other words, although common sense dictates that drivers take shorter glances when looking further to the left or right (which they need to do for parallel mounted signs), this has not been confirmed by the existing research.

Glance Frequency

Smiley, et al. (2004) reviewed the literature on driver eye movements and found that drivers typically look two to three times at guide signs and about two times at warning and regulatory signs. Smiley's own research on driver fixation patterns for EMCs resulted in an average of 1.9 glances per sign. Beijer (2003) found that drivers glance at EMCs an average of 1.3 times. Neither Beijer nor Smiley discussed whether the low number of glances per sign was a function of the limited time available, or if one to two glances was sufficient for drivers to gather as much information as they needed from the signs.

Sign Reading Speed

Roadside signs can only be read in short spurts as the driver looks from the road to the sign and back to the road again. This type of reading task is known as "glance legibility," for which reading speed is a critical element. The research on reading speed was reviewed to determine how long it takes to read roadside signs and how to maximize sign reading speed in order to minimize the time drivers must look away from the road.

Proffitt, Wade, and Lynn (1998) reported normal text reading speed (book or monitor) for adults to be about 250 words per minute, or 4.2 words per second. However, research on highway sign reading provides evidence that it takes drivers anywhere from 0.5 to 2.0 seconds to read and process a single sign word or unit of information (Garvey and Kuhn, 2004). This is two to eight times slower than normal reading speed. A concept known as *critical print size* may explain some of the disparity between normal reading speed and the time it takes to read a roadside sign.

One reason drivers read signs slowly is that they begin to read them as soon as they become legible; that is, at acuity threshold. Von Hemel and Von Hemel (2004) wrote, "Typically, people need letters larger than their acuity limit to read quickly and without fatigue." Reading speed increases with above threshold print size up to a point, levels off, and then drops again at very large print sizes (Chung, et al., 1998). The point where reading speed levels off is the critical print size, defined as the smallest letter height necessary for maximum reading speed. Although it varies a great deal depending on the viewer and the task, critical print size is typically believed to be between two to three times size threshold (Van Hemel and Van Hemel, 2004; and Cheong, Lovie-Kitchin, and Bowers, 2002). Although the research on this topic has been limited to small formats, applying this concept to parallel sign letter height could help maximize sign reading speed.

Observation Angle

As drivers get closer to a parallel mounted sign, the angle increases from nearly 0° when they are far down the road, to 90° when the car is beside the sign (Figure 4). At 90° the sign is optimally legible, however at that angle the sign can only be viewed through either the passenger or driver side window.

Signs begin to be legible at a "threshold observation angle" somewhere between 0° and 90°. Of course, the threshold observation angle is not a static number and will vary as a function of letter height and width, color and luminance contrast, typeface style, and letter spacing. This angle however, is critical to the development of a mathematical model for parallel commercial sign letter height. For that model to be generalizable, the selected threshold angle must represent most sign conditions, for an error (such as choosing 45° when in reality it is 30°, or vice versa) could result in signs with half or twice the required letter height.

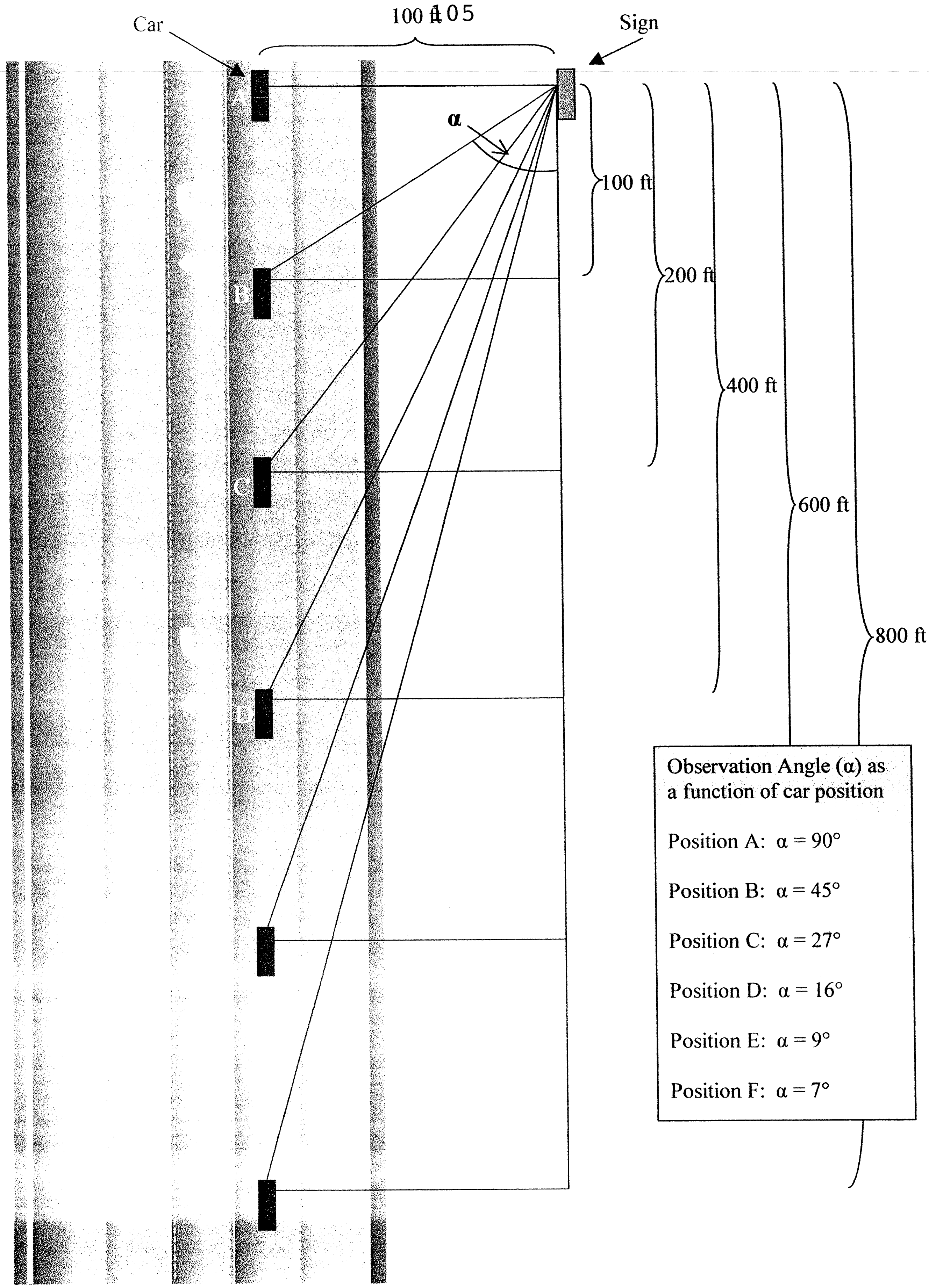

Figure 4. Change in observation angle with distance.

In their Signage System Overview document (FIP, 1992), the Treasury Board of Canada wrote, "Ideally, a sign should be placed at a right angle to the observer's central line of vision; that is, the viewing angle should be nearly 90 degrees. The legibility of a sign message deteriorates when the viewing angle is less than 45 degrees." Prince (1958) actually recommended that the messages on signs at angles smaller than 20 degrees be manipulated through increases in height and/or width to appear "normal" to the observer. And in a section on parking signs in the Manual on Uniform Traffic Control Devices (USDOT, 2003), the U.S. Federal Highway Administration wrote, "signs should be set at an angle of not less than 30 degrees nor more than 45 degrees with the line of traffic flow in order to be visible to approaching traffic." David Young (2003) discussed the effect of observation angle on the legibility of safety signs. Although the report offered no data, Young stated, "I recommend the angle between the sign and the line of sight should not be less than 30°."

In a literature review of research on visual displays, Buckler (1977) found reading performance to decline beginning somewhere between 19° and 38° from perpendicular (71° and 52° observation angles). He recommended a minimum observation angle of 60° for classroom viewing of CRTs. Rothblum (1983) reviewed the literature on dot matrix displays and concluded that "legibility begins to decrease with viewing angles larger than 30° to 45°" (observation angles of 60° to 45°).

Griffin and Bailey (2002) conducted the one empirical research effort that specifically evaluated the effect of observation angle on sign legibility. These researchers tested a single font (Snellen) with two intercharacter spacings (greater than letter width; and about ¼ letter width) and a letter height set slightly above acuity threshold. They found that with the tighter spacings, their subjects were able to correctly read 85 percent of the sign letters at an observation angle of about 58°, with performance dropping off dramatically at tighter angles (less than 25 percent correct letter identification at 30°). However, when perceived letter height was doubled and intercharacter spacings were large, the subjects were able to correctly identify 85 percent of the sign letters at an observation angle of about 30°, even though they were wearing special glasses that blurred their vision.

Model

Overview

The minimum distance at which a sign must become legible is a function of the time it takes to read the sign and the decisions and maneuvers required to comply with the sign. This is sometimes called the perception-reaction or PIEV time (Perception, Identification, Emotion, and Volition) and combined with travel speed the resulting distance is known as the minimum required legibility distance. Given the MRLD, the sign's letter size is back-calculated using an LI or legibility index.

The LI is expressed in feet of legibility distance as a function of letter height in inches (ft/in). For example, an LI of 30 means that a sign with an MRLD of 570 feet must have 19-inch letters (570 / 30 = 19). As mentioned earlier, a legibility index table was developed by the USSCF to help users select appropriate letter heights for perpendicular mounted signs with known MRLDs (Table 1).

Restricted viewing angles curtail parallel sign sight distance, therefore the distance used for calculating their letter height is not the MRLD, but rather the MALD or maximum available legibility distance. This is the sight distance between the driver and the sign at the angle where the sign first becomes legible. This distance is calculated using the number of travel lanes, the sign's lateral offset from the curb, and the threshold observation angle discussed above. For the model this is assumed to be 30° (Figure 5 illustrates how letter height is calculated).

Technically, the MALD is the *hypotenuse* (longest leg) of a 30-60-90° triangle (Figure 5, lower right). The *adjacent* leg of the triangle is the horizontal offset of the sign from the driver's eye. Using the special characteristics of 30-60-90° triangles, we know that the hypotenuse is double the length of the adjacent leg, so the MALD is double the offset from the driver's eye. The *opposite* leg is the distance the driver must travel along the road from the MALD to the point where the vehicle is alongside the sign. The time it takes to travel this distance is a function of speed and represents the absolute maximum window of opportunity that drivers have to read parallel signs (Table 2). The actual time they spend looking at these signs will of course be a small fraction of this window and will be a function of traffic volume and environmental conditions that include weather as well as potential blocking of the sign by other vehicles and roadside obstacles (Pietrucha, et al., 2003).

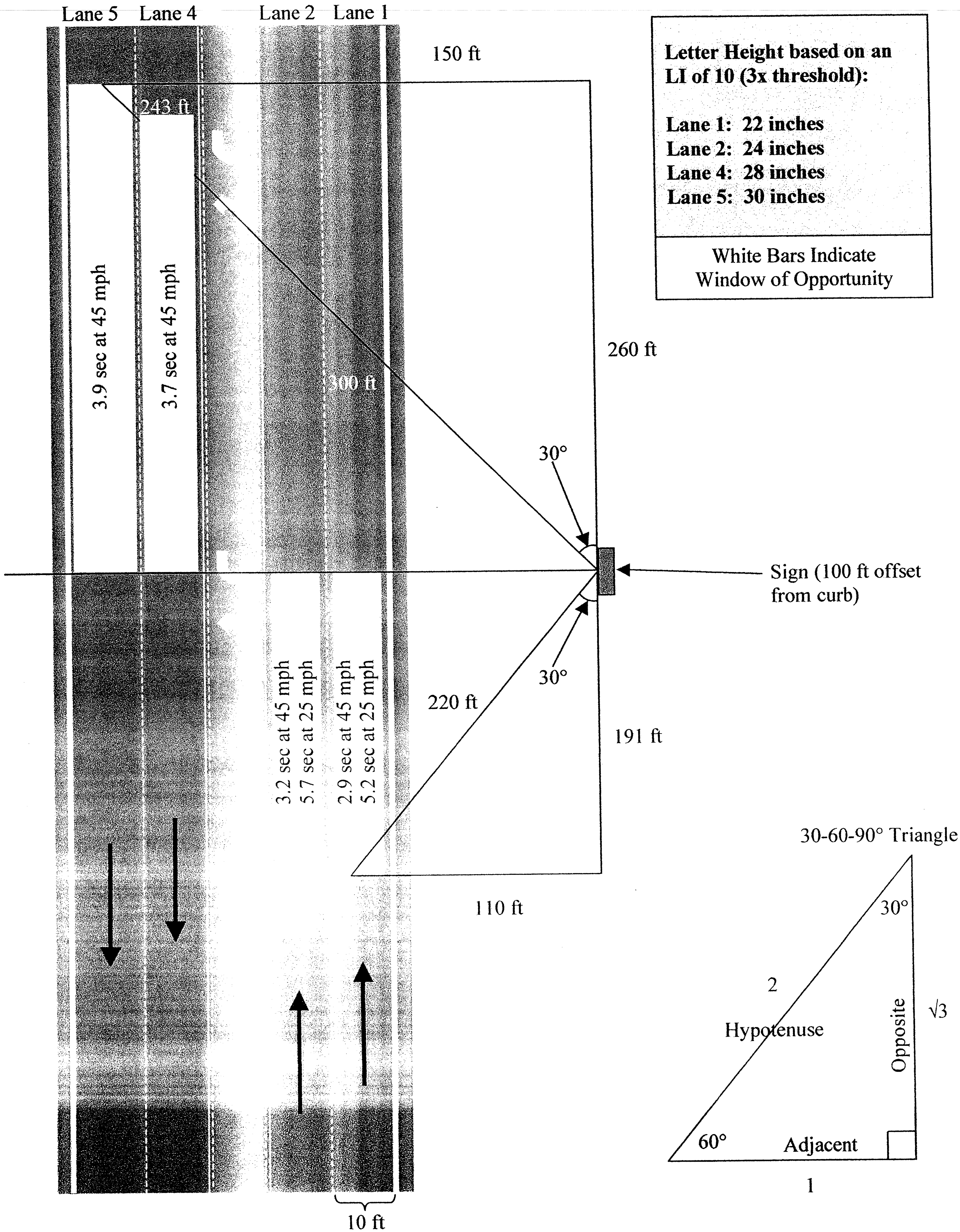

Figure 5. Example calculation for letter height model.

Table 2. Window of opportunity to read parallel signs (in seconds).

25 mph Speed Limit

Offset from Curb	Number of Lanes: 1	2	3	4	5
10	0.94	1.42	1.89	2.36	2.83
20	1.42	1.89	2.36	2.83	3.31
40	2.36	2.83	3.31	3.78	4.25
60	3.31	3.78	4.25	4.72	5.20
80	4.25	4.72	5.20	5.67	6.14
100	5.20	5.67	6.14	6.61	7.09
125	6.38	6.85	7.32	7.79	8.27
150	7.56	8.03	8.50	8.98	9.45
175	8.74	9.21	9.68	10.16	10.63
200	9.92	10.39	10.86	11.34	11.81

45 mph Speed Limit

Offset from Curb	Number of Lanes: 1	2	3	4	5
10	0.52	0.79	1.05	1.31	1.57
20	0.79	1.05	1.31	1.57	1.84
40	1.31	1.57	1.84	2.10	2.36
60	1.84	2.10	2.36	2.62	2.89
80	2.36	2.62	2.89	3.15	3.41
100	2.89	3.15	3.41	3.67	3.94
125	3.54	3.81	4.07	4.33	4.59
150	4.20	4.46	4.72	4.99	5.25
175	4.85	5.12	5.38	5.64	5.90
200	5.51	5.77	6.04	6.30	6.56
225	6.17	6.43	6.69	6.95	7.22
250	6.82	7.09	7.35	7.61	7.87
275	7.48	7.74	8.00	8.27	8.53
300	8.14	8.40	8.66	8.92	9.19
325	8.79	9.05	9.32	9.58	9.84
350	9.45	9.71	9.97	10.23	10.50
375	10.10	10.37	10.63	10.89	11.15
400	10.76	11.02	11.28	11.55	11.81

Optimizing Reading Speed

It is essential to optimize reading speed for parallel mounted signs in order to minimize the duration and frequency of glances that drivers must make at these signs and to maximize the time they have for the primary visual driving tasks. In other words, to minimize driver distraction.

The research on *acuity reserve* (the difference between size threshold and critical print size) was used to determine how much larger than threshold parallel sign letters must be to minimize glance duration and frequency. As mentioned earlier, the research shows that people read the fastest at about two to three times threshold letter height. To ensure adequate letter height, a multiplier of three times threshold was selected for use in the model. This increase in threshold letter height will also improve the likelihood that drivers will be able to begin reading signs at the 30° observation angle (Griffin and Bailey, 2002). A threshold legibility index of 30 ft/in was chosen as an average of the USSCF LIs. Providing a minimum angle of resolution of just under 2.0 minutes of arc, the LI of 30 is consistent with threshold letter height for drivers with 20/40 visual acuity (the minimum acuity allowed to obtain a driver's license in most states). Three times the threshold letter height results in an LI of 10 ft/in.

Equations and Lookup Table

The following equations can be used to determine appropriate letter heights for parallel mounted signs given the number of lanes of travel and the lateral offset of the sign from the curb. Equation #1 uses an average LI of 10, while Equation #2 allows users to input the LI that most closely matches their sign conditions from the USSCF LI table (Table 1) and applies the three times threshold constant to that LI. A parallel sign letter height lookup table is provided for typical roadway cross-sections and lateral sign offsets (Table 3).

When using the equations or the lookup table always use the maximum number of lanes on the primary target road.

Parallel Letter Height Model Equations

Equation #1: $LH = (LN * 10 + LO) / 5$

Equation #2: $LH = (LN * 10 + LO) / (LI/6)$

where:

LH is letter height in inches.

LN is the number of lanes of traffic.

LO is the lateral offset from curb in feet.

LI is the legibility index from Table 1.

Practical Examples:

2-Lane Roadway
Lateral offset is 37 feet from the curb.
User does not know the letter style.

Equation #1: LH = (LN * 10 + LO) / 5

LH = (2 * 10 + 37) / 5

LH = 57 / 5

LH = 11.4 inches

Same scenario, but user knows the sign is:

External Illuminated, Helvetica, all Caps, Light Letters on Dark Background

(USSCF LI = 22 ft/in)

Equation #2: LH = (LN * 10 + LO) / (LI/6)

LH = (2 * 10 + 37) / (22/6)

LH = 57 / 3.67

LH = 15.5 inches

Table 3. Parallel sign letter height lookup table.

	Letter Height in Inches				
	Number of Lanes				
Offset from Curb (ft)	1	2	3	4	5
10	4	6	8	10	12
20	6	8	10	12	14
40	10	12	14	16	18
60	14	16	18	20	22
80	18	20	22	24	26
100	22	24	26	28	30
125	27	29	31	33	35
150	32	34	36	38	40
175	37	39	41	43	45
200	42	44	46	48	50
225	47	49	51	53	55
250	52	54	56	58	60
275	57	59	61	63	65
300	62	64	66	68	70
325	67	69	71	73	75
350	72	74	76	78	80
375	77	79	81	83	85
400	82	84	86	88	90

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Attachment G

USSC

Sign Legibility Rules Of Thumb

UNITED STATES SIGN COUNCIL

SIGN LEGIBILITY

By Andrew Bertucci, United States Sign Council

Since 1996, the United States Sign Council (USSC) and its research arm, the United States Sign Council Foundation (USSCF) have funded an extensive array of studies into the legibility of on-premise signs and the manner in which motorists react to these signs in various roadside environments. Because of these ground breaking studies, it is now possible to determine, with a degree of certainty, the size of letters as well as the size of signs necessary to ensure motorist legibility. Most of this work has been synthesized in the current USSC publication entitled ***USSC Best Practices Standards for On-Premise Signs***, which details methods for ascertaining sign size, legibility, and height for on-premise signs that are directly in view of a motorist approaching the sign. In addition, a study completed in 2006 and entitled ***On-Premise Signs, Determination of Parallel Sign Legibility and Letter Heights*** now provides similar methods for ascertaining legibility factors for signs not directly in view, such as wall mount building signs usually parallel to a motorist's viewpoint.

The USSC Best Practices Standards and the parallel sign study offer relatively detailed analysis of the legibility factors involved with on-premise signs, and certainly should be utilized whenever such analysis is warranted. A number of equally useful generalizations, or time-saving rules-of-thumb based on the studies, however, can be applied to arrive at results which reflect legibility values which can be used as a general average applicable to most conditions. These are detailed below.

On Premise Sign Legibility Simplified Rules Of Thumb

How Motorists React To Signs In The Roadside Environment

Detecting and reading a roadside on-premise sign by a motorist involves a complex series of sequentially occurring events, both mental and physical. They include message detection and processing, intervals of eye and/or head movement alternating between the sign and the road environment, and finally, active maneuvering of the vehicle (such as lane changes, deceleration, and turning into a destination) as required in response to the stimulus provided by the sign.

Complicating this process is the dynamic of the viewing task, itself, involving the detection of a sign through the relatively constricted view provided by the windshield of a rapidly moving vehicle, with the distance between the motorist and the sign quickly diminishing. At 40 miles per hour, for example, the rate at which the viewing distance decreases is 58 feet per second, and at 60 miles per hour, it becomes an impressive 88 feet per second. Further complicating the process is the relative position of the sign to the eye of the motorist, whether directly in his/her field of view (perpendicular orientation), or off to the side and turned essentially parallel to the motorist's field of view (parallel orientation).

Research has now been able to quantify the viewing process and set a viewing time frame or viewing window of opportunity for both types of sign orientation. In the case of signs perpendicular to the motorist, this time frame is measured as Viewer Reaction Time (VRT), or the time frame necessary for a motorist traveling at a specific rate of speed to detect, read, and react to a sign within his/her direct field of vision with an appropriate driving maneuver. The driving maneuver itself can entail a number of mental and physical reactions, usually involving signaling, lane changes, acceleration and/or deceleration, and finally, a turn into the site of the sign.

In the case of signs parallel to the motorist's view, detecting and reading a sign is generally restricted to quick sideways glances as the sign is approached and the angle of view becomes more constricted. Because of this, the VRT involving these signs is, at best, necessarily compromised. Compensation for this reduction in the time frame involved in detecting and reading parallel signs is made through increases in letter height and size designed to facilitate rapid glance legibility. It must be understood however, that the parallel orientation will always present legibility problems, and in many cases, even if the sign is detected and read, sufficient time for a motorist to complete a driving maneuver in response to the sign may not be available.

Perpendicular Signs

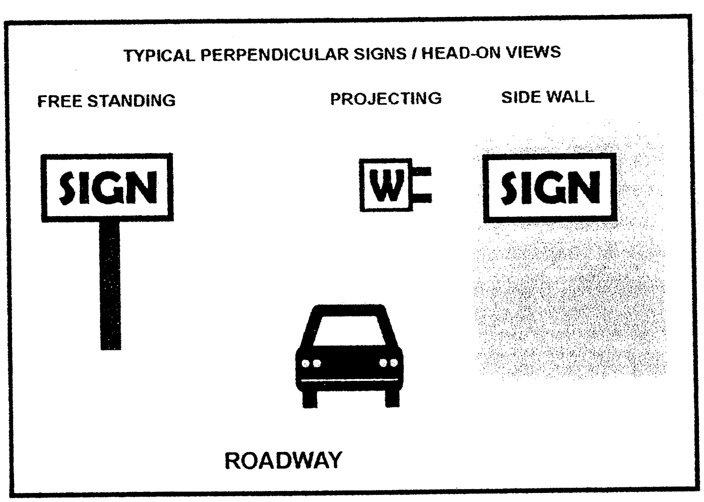


Figure 1. Perpendicular Sign Types

Perpendicular signs include most free standing signs, projecting signs, and, in some cases, flat wall signs placed on building walls that directly face on-coming traffic. (see figure 1). These signs are generally placed close to property lines and fall into the motorist's so-called "cone of vision", which is a view down the road encompassing ten degrees to the right or left of the eye, or twenty degrees total view angle. Signs falling within this cone can usually be viewed comfortably without excessive eye or head movement, and generally can be kept in the motorist's line-of-sight from the time they are first detected until they are passed. (see figure 2, cone of vision).

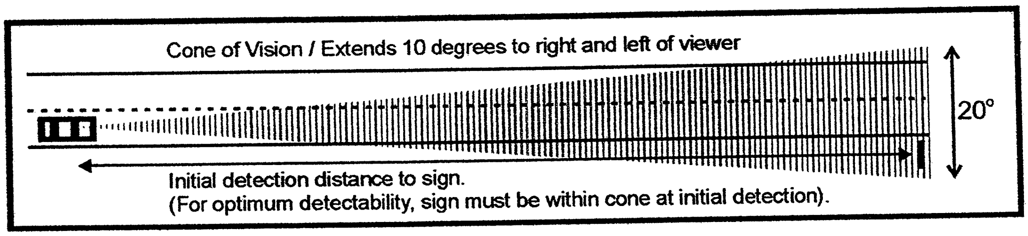


Figure 2. Cone of Vision

Because of this relatively constant view window, perpendicular signs can be designed and sized to provide for viewing time sufficient to allow for adequate detection, reading, and driving maneuvers. The key to providing adequate viewing time is an understanding of Viewer Reaction Time and Viewer Reaction Distance, and how these factors can be computed to provide for adequate letter heights and sign sizes under varied traffic conditions and vehicle speeds.

Viewer Reaction Time / Viewer Reaction Distance

Viewer Reaction Time is simply the time necessary for a motorist to detect, read, and react to the message displayed on an approaching on-premise sign that lies within his or her cone of vision. The USSC Guideline Standards offer precise mathematical procedures for calculating VRT for specific signs with specific copy located in varied locations of increasing traffic complexity and speed.

As a rule-of-thumb for average usage with signs displaying six words of copy (or 30 letters) or less however, VRT for vehicles traveling under 35 miles per hour in simple two to three lane environments can be estimated at eight (8) seconds; for vehicles traveling over 35 miles per hour in more complex four to five lane environments, at ten (10) seconds; and for vehicles traveling over 35 mph in high speed multi-lane environments at eleven to twelve (11-12) seconds.

These values include a maneuvering time of 4 seconds in the simple environment, 5 seconds in the complex environment, and 6 seconds in the high speed multi-lane environment. Although most roadside on-premise sign installations require a motorist to make the driving maneuver before the sign is passed and thus require the full VRT value, occasionally the maneuver can safely be made after the sign location has been passed. Where this is the case, the driving maneuver time of either 4, 5, or 6 seconds should not be included in computing Viewer Reaction Time.

Once VRT is ascertained, Viewer Reaction Distance for a given sign location, or the distance in feet which a vehicle travels during the VRT interval, can be calculated. It is necessary to know this distance because it determines the size of the letters and the size of the sign necessary for legibility to take place over that distance. It represents, in lineal feet, the distance between the motorist and the sign from the moment he or she has first detected it, and it rapidly diminishes as the motorist closes the distance at speed.

It is calculated by first converting travel speed in miles per hour (MPH) to feet per second (FPS) by using the multiplier 1.47, and then multiplying the feet per second by the Viewer Reaction Time. For example, a vehicle traveling at sixty miles per hour covers eighty-eight feet per second (60 x 1.47 = 88). Eighty-eight feet per second times a Viewer Reaction Time of ten seconds equals eight hundred eighty feet (880) of Viewer Reaction Distance. The computation can be expressed also as this equation:

VRD = (MPH) (VRT) 1.47

Determining Letter Height and Sign Size

The overall legibility of a sign is essentially determined by the height, color, and font characteristics of the letters making up its message component. To this end, the USSC has, through extensive research, developed standard legibility indices for typical letter types and color combinations (see table 1, USSC Standard Legibility Index).

The Legibility Index (LI) is a numerical value representing the distance in feet at which a sign may be read for every inch of capital letter height. For example, a sign with a Legibility Index of 30 means that it should be legible at 30 feet with one inch capital letters, or legible at 300 feet with ten inch capital letters. The USSC Standard Legibility Index also reflects the 15 percent increase in letter height required when all upper case letters (all caps) are used instead of more legible upper and lower case letters with initial caps.

Table 1. The USSC Standard Legibility Index

ILLUMINATION	LETTER STYLE	LETTER COLOR	Background COLOR	LEGIBILITY INDEX	
				Upper & Lower Case	ALL CAPS
External	Helvetica	Black	White	29	25
External	Helvetica	Yellow	Green	26	22
External	Helvetica	White	Black	26	22
External	Clarendon	Black	White	28	24
External	Clarendon	Yellow	Green	31	26
External	Clarendon	White	Black	24	20
Internal Translucent	Helvetica	Black	White	29	25
Internal Translucent	Helvetica	Yellow	Green	37	31
Internal Translucent	Clarendon	Black	White	31	26
Internal Translucent	Clarendon	Yellow	Green	37	31
Internal Opaque	Helvetica	White	Black	34	29
Internal Opaque	Helvetica	Yellow	Green	37	31
Internal Opaque	Clarendon	White	Black	36	30
Internal Opaque	Clarendon	Yellow	Green	37	28
Neon	Helvetica	Red	Black	29	25
Neon	Helvetica	White	Black	38	32

Illumination Variations:

External light source
Internal light source with fully translucent background
Internal light source with translucent letters and opaque background
Exposed neon tube

To use the Legibility Index table to determine letter height for any given viewing distance, select the combination of font style, illumination, letter color, and background color that most closely approximates those features on the sign being evaluated. Then, divide the viewing distance (Viewer Reaction Distance) in feet by the appropriate Legibility Index value. The result is the letter height in inches for the initial capital letter in upper and lower case configurations, or for every letter in an all caps configuration. For example, if the Viewer Reaction Distance is 600 feet, and the Legibility Index is 30, the capital letter height would be 20 inches (600'/30 = 20").

VRD (in feet) / LI = Letter Height (in inches)

The Legibility Index rule-of-thumb…30

In addition to the use of the Legibility Index chart, a simpler, rule-of-thumb Legibility Index of 30 is frequently used as an average to address most legibility requirements. Although generally acceptable, it should be understood that this is an average only, and it may fall short of meeting the legibility needs of any specific sign or environment. The USSC On-Premise Sign Standards provides a much more precise means of establishing this requirement, particularly for complex environments, and should be used whenever such precision is warranted.

Sign Copy Area and Negative Space – Computing Sign Size

The computation of overall sign size is of vital concern to anyone involved in designing or building on-premise signs, since it relates directly to both sign cost as well as to adherence to local building and zoning ordinances. It is for this reason that USSC has devoted so much research resources into developing methods for computing adequate sign sizes for varied environments, and into providing the industry with the means to compute the size of signs necessary to adequately transmit communicative messages to motorists traveling at different rates of speed. The use of the Legibility Index is the vital first step in this process, but there is frequently more involved than just letter height, especially in perpendicular signs involving the use of background panels. Clearly, in these instances, an understanding of how sign copy area and negative space interact to bring about optimum viewer legibility is critical.

In instances in which only letters comprise the total sign, such as channel letters on building walls, however, the computation of total sign size in square feet is relatively simple. In the case of these types of individual letter signs, overall size is frequently considered as the product of the height of the letters times the length of the line of letters. For example, if capital letter height is two feet, and the line of letters measures thirty feet horizontally, sign size would be calculated at sixty square feet (2 x 30 = 60). There is an important exception to this mode of calculation in which only the space actually taken up by the letters themselves in square feet, and not the space between letters, is considered. In these cases, overall size becomes simply the sum of all the individual letter areas, and is generally a fairer method of computation when the letters and or/symbols are spread out over a large area of building wall. In any event, for individual letter signs, it is essentially the height of the letters which is the prime determinant of overall sign size, and as we observed above, this can be calculated with some precision through use of the Legibility Index.

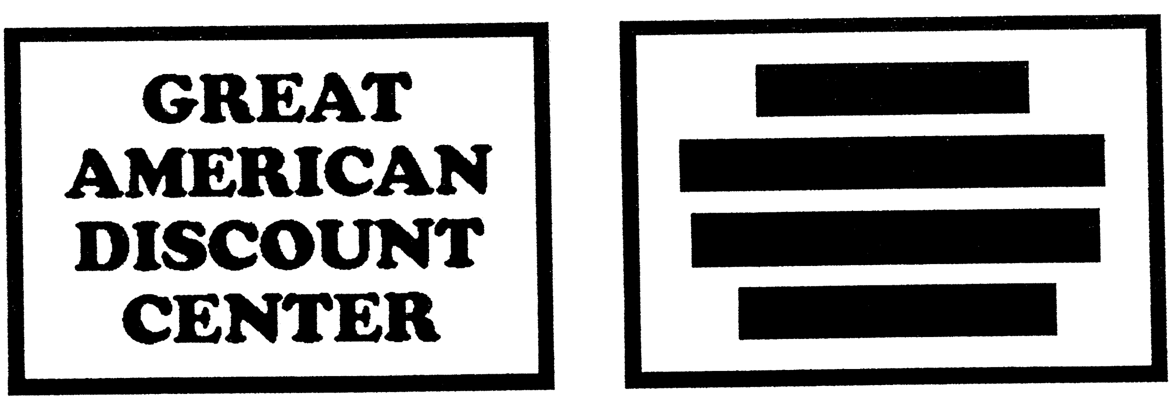
In this context, there is also another useful rule of thumb which can be used to give a working approximation of how much horizontal length a given number of letters would require once the letter height is established by simply multiplying capital letter height by the number of letters. For average fonts, this rule of thumb takes into account the space between letters in a line (usually 1/3 the width of an individual letter and referenced as letterspace) and can give a surprisingly close determination of the actual length of the line of letters.

In the case of signs utilizing background areas, however, computation of the amount of space occupied by the lettering, also called copy area, is only the first step in computing overall sign size. Of equal importance in signs of this type is the amount of negative space surrounding the letters or copy area. It is this negative space which provides the background for the letters, makes legibility possible, and which must be accounted for in any computation to determine overall sign size.

Copy Area

The copy area of a sign is that portion of the sign face encompassing the lettering and the space between the letters (letterspace), as well as any symbols, illustrations, or other graphic elements. It is a critical component of effective sign design because it establishes the relationship between the message and the negative space necessary to provide the sign with reasonable legibility over distance.

Figure 3. Copy Area

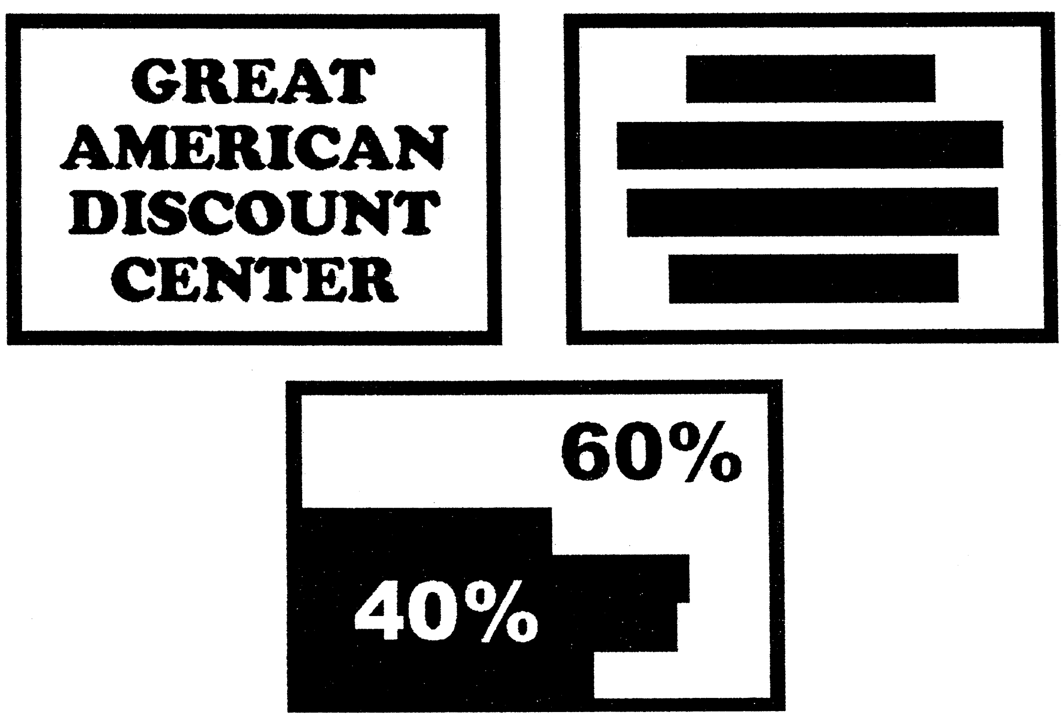


The illustration on the left depicts a typical on-premise sign face; while the one on the right, with black rectangles covering the copy area, affords a visual of the message layout

Negative Space

Negative space is the open space surrounding the copy area of a sign. It is essential to legibility, particularly in signs in which the copy is displayed within a background panel. Negative space ideally should not be less than 60 percent of the sign or background area. This requirement for a 40/60 relationship between the copy area and negative space is the minimum USSC standard. It is intended only to establish a measurable baseline for the negative space component of a sign, such that a reasonable expectation of legibility will exist.

Figure 4. Relationship Between Copy Area And Negative Space



The bottom sign panel illustrates how the aggregate copy area comprises 40 percent of the total sign panel area, with the remaining 60 percent forming the negative space area.

DETERMINING SIGN SIZE – Calculation Methodology

The size of a sign is determined by the size and length of the message and the time required to read and understand it. It can be calculated once the numerical values of the five size determinants –Viewer Reaction Time, Viewer Reaction Distance, Letter Height, Copy Area, and Negative Space – have been established.

The step-by-step process to determine sign size, which is explained below, is useful not only as a calculation method, but also as a means of understanding the elements involved in the calculation.

Area of Sign / Computation Process:

1. Determine speed of travel (MPH) in feet per second (FPS): (MPH x 1.47).
2. Determine Viewer Reaction Time (VRT).
3. Determine Viewer Reaction Distance (VRT x FPS).
4. Determine Letter Height in inches by reference to the Legibility Index (LI): (VRD/LI).
5. Determine Single Letter Area in square inches (square the letter height to obtain area occupied by single letter and its adjoining letterspace).
6. Determine Single Letter Area in square feet: Single Letter Area in square inches/144).
7. Determine Copy Area (Single Letter Area in square feet x total number of letters plus area of any symbols in square feet).
8. Determine Negative Space Area at 60% of Sign Area (Copy Area x 1.5).
9. Add Copy Area to Negative Space Area.
10. Result is Area of Sign in square feet.

Computation Process / Calculation Example

Figure 5. Calculation Example Sign

Location: Complex Driving Environment

Posted Traffic Speed of 40 MPH

Sign Background: White

Sign Copy: 23 Letters, Upper & Lower Case

Clarendon Style, Black

Internally Illuminated, Translucent Face

1. Determine speed of travel in feet per second; 40 MPH x 1.47 = 59 FPS
2. Determine Viewer Reaction Time – Complex Environment
   Detection and Message Scan...................... 5 seconds
   Maneuver... 5 seconds
   Total Viewer Reaction Time = 10 seconds VRT
3. Determine Viewer Reaction Distance; 59 (FPS) x 10 (VRT) = 590 feet
4. Determine Letter Height in inches - Refer to Legibility Index, Table 1
   Black Clarendon letters on White background = Index of 31
   590 (VRD) / 31 (LI) = 19 inch letter height
5. Determine Single Letter Area in square inches
   19 x 19 = 361 square inches, single letter area
6. Determine Single Letter Area in square feet
   361 / 144 = 2.5 square feet, single letter area
7. Determine Copy Area; single letter area (sq. ft.) x number of letters
   2.5 x 23 = 57.5 square feet, copy area
8. Determine Negative Space @ 60% of sign area
   57.5 x 1.5 = 86.25 square feet, negative space
9. Add Copy Area to Negative Space
   57.5 + 86.25 = 143.75 square feet
10. Result is Area of Sign, 144 square feet

Area of Sign – Equation / Specific Usage

In addition to the computation method above, the USSC has developed an algebraic equation to determine the Area (A_{sign}) for signs containing letters only, which will provide the same result but will simplify the process. The equation allows for insertion of all of the size determinants, except for Negative Space, which is fixed at the standard 40/60 ratios. (Note: If numbers are rounded off in the computation process, a very slight difference in result may occur between the computation process and the equation).

$$A_{sign} = \frac{3n}{80}\left[\frac{(VRT)(MPH)}{LI}\right]^2$$

Fixed Value:
- 40/60 ratio, letters/negative space

Variable Values:
- Number of Letters (n)
- Viewer Reaction Time (VRT)
- Miles Per Hour (MPH)
- Legibility Index (LI)

Here's how to work the equation:

Start with the first portion of the equation which is three times the number of letters divided by 80. Three times 23 letters is 69; when divided by 80 the result is .8625. Keep this number ready for later use. Compute the second part of the equation in brackets by multiplying VRT (Viewer Reaction Time), which is 10 by the MPH (miles per hour), which is 40. The multiplication product is 400. Divide 400 by the LI (Legibility Index), which is 31, and the result is 12.90. Square the 12.90 by multiplying it by itself (12.90 x 12.90) for a product of 166. Finally, multiply the 166 by the .8625 obtained from the first part of the equation, and the resulting square footage is 143.

Area of Sign – Equation / Broad Usage

To allow for a broader scientific evaluation of sign size and satisfy the minimal legibility requirements across a full range of reaction times and speed zones, USSC has also developed a second more simplified equation shown below. This formula fixes the average sign size determinants, leaving only Viewer Reaction Time (VRT) and the speed of travel (MPH) as the sole variables. It can be used effectively as a broad rule-of-thumb to ascertain the general size of signs necessary to adequately and safely convey roadside information to motorists traveling at a given rate of speed as well as to establish size parameters for signs across an entire community and/or road system. Table 2 below provides a handy look-up reference of the use of the equation.

$$A_{sign} = \frac{[(VRT)(MPH)]^2}{800}$$

Fixed Values:
- 30 Letters
- Legibility Index (LI) of 30
- 40/60 ratio, letters/negative space

Variable Values:
- Viewer Reaction Time (VRT)
- Miles Per Hour (MPH)

Here's how to work the equation,
assuming Viewer Reaction Time of 10 seconds and speed at 50 miles per hour:

Compute the values in the brackets by multiplying the VRT (Viewer Reaction Time) of 10 seconds by the MPH (miles per Hour), which is 50. The multiplication product is 500. Square the 500 by multiplying it by itself (500 x 500) for a product of 250,000. Divide 250,000 by 800 for the resulting square footage of 312.

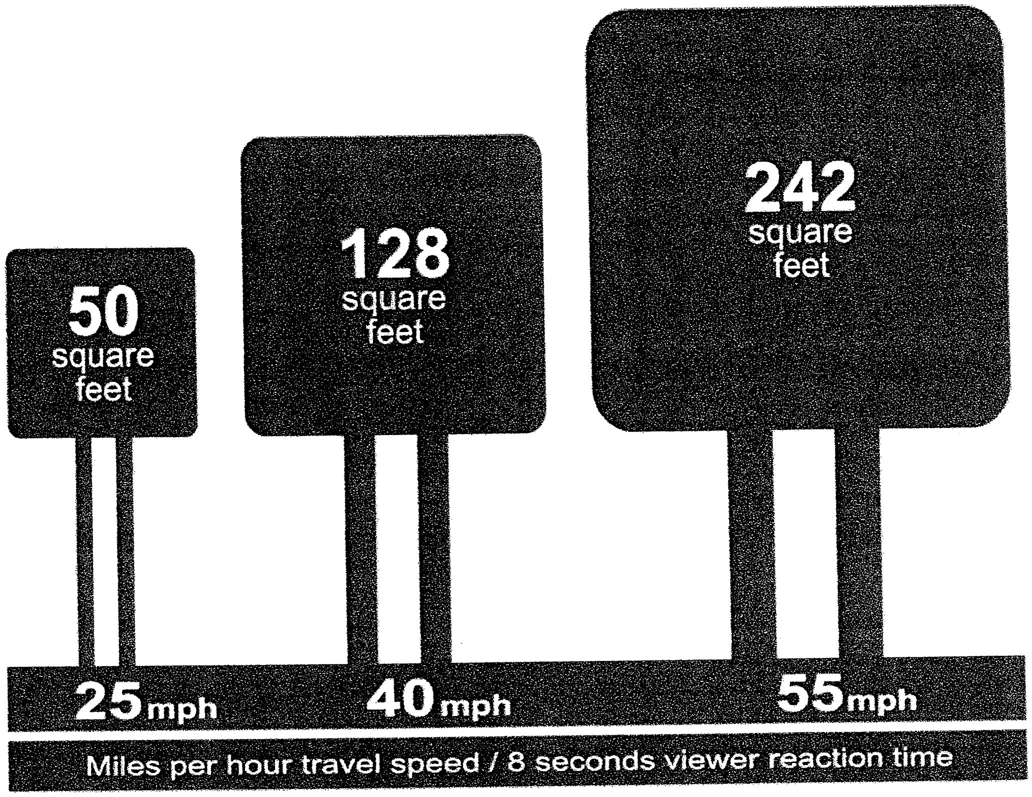
Table 2. Freestanding Sign Sizes

Freestanding Sign Size in Square Feet

Sign Size (Square Feet) = $[(VRT)(MPH)]^2 / 800$

VRT = Viewer Reaction Time   MPH = Miles Per Hour
VRT varies with roadside complexity:
simple or 2 lane = 8 seconds / complex or 4 lane = 10 seconds / multi lane = 11 seconds

MPH	Road Complexity	VRT	Sign Size
25	simple / 2 lane	8	50
25	complex / 4 lane	10	78
30	simple / 2 lane	8	72
30	complex / 4 lane	10	112
35	simple / 2 lane	8	98
35	complex / 4 lane	10	153
40	simple / 2 lane	8	128
40	complex / 4 lane	10	200
45	simple / 2 lane	8	162
45	complex / 4 lane	10	253
50	simple / 2 lane	8	200
50	complex / 4 lane	10	312
55	complex / 4 lane	10	378
60	complex / 4 lane	10	450
65	multi lane	11	639
70	multi lane	11	741
75	multi lane	11	850



Average sign size related to speed of travel and reaction time

Jmmt usbujpo!gspn !Tusf f uHsbqi jdt !boe!ui f !Mbx -
Bn f sjdbo!Qmboojoh!Bt t pdjbujpo-!3115

Parallel Signs

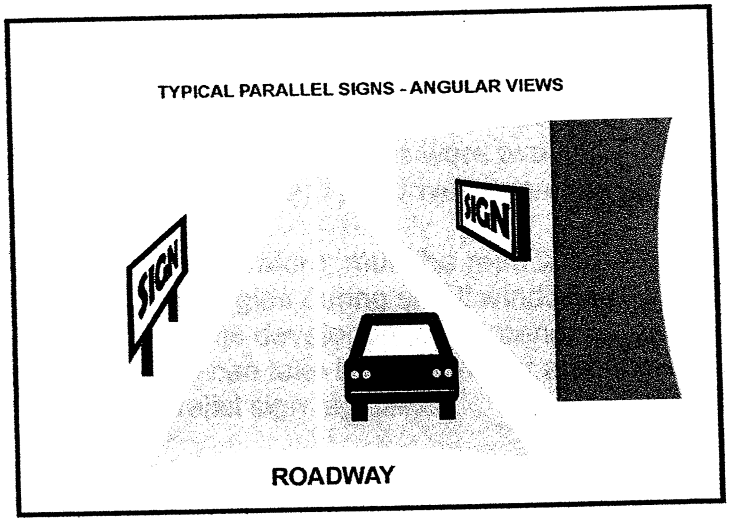


Figure 6. Parallel Sign Types

Everyday experience teaches us that parallel signs are more difficult to read than perpendicular signs simply because their orientation to the eye of any observer is at an acute angle. Now USSC research has corroborated this subjective impression with scientific evidence, and has made it possible to construct a mathematical model and attendant equations to account for the size increases necessary to allow parallel oriented signs to achieve at least some measure of the legibility quotient of perpendicular signs in a motorist oriented environment.

Parallel signs are harder to read because their orientation, or tilt, with respect to the driver makes it impossible to see the sign face at certain distances and offsets. When the driver can see the sign face, the content is often foreshortened and distorted. The driver must get close to the sign in order to increase the viewing angle to the point where the sign becomes legible. However, as drivers approach the sign, the time they have to read it gets shorter, while the sign moves further into their peripheral vision.

This condition places parallel signs at a threefold disadvantage relative to perpendicular signs. First, they are inherently more difficult to read because of the foreshortening of the message content caused by the angle of view. Second, because they become legible only after the angle of view exceeds 30 degrees, the time frame during which legibility can take place is compressed, and third, because they are usually placed back from the roadside well outside a driver's cone of vision, they are viewed by drivers only during short sideway glance durations, usually measured in fractions of seconds.

parallel sign with a MALD of 500 feet, for example, would require a capital letter size of 50" (500/10=50). Conversely, a perpendicular sign at the same location, but directly viewable 500 feet down the road, would require a capital letter size of 17" (500/30=17)

Equations and Lookup Table

The following equations can be used to determine appropriate letter heights for parallel mounted signs given the number of lanes of travel and the lateral offset of the sign from the curb. Equation #1 uses an average LI of 10, while Equation #2 allows users to input the LI that most closely matches their sign conditions from the USSC Legibility Index table (Table 1) and applies the three times threshold constant to that LI. A parallel sign letter height lookup table is also provided for typical roadway cross-sections and lateral sign offsets (Table 3).

When using the equations or the lookup table always use the maximum number of lanes on the primary target road.

Parallel Letter Height Model Equations

Equation #1: $$LH = (LN \times 10 + LO) / 5$$

Equation #2: $$LH = (LN \times 10 + LO) / (LI / 6)$$

where:

LH is letter height in inches.

LN is the number of lanes of traffic.

LO is the lateral offset from curb in feet.

LI is the legibility index from Table 1

Examples of how to work the equations

2-Lane Roadway
Lateral offset is 37 feet from the curb.
User does not know the letter style.

Equation #1: ***LH = (LN x 10 + LO) / 5***

LH = (2 x 10 + 37) / 5
LH = 57 / 5
LH = 11.4 inches

Same scenario, but user knows the sign is: Externally Illuminated, Helvetica, all Caps, Light Letters on Dark Background
(USSC LI = 22 ft/in)

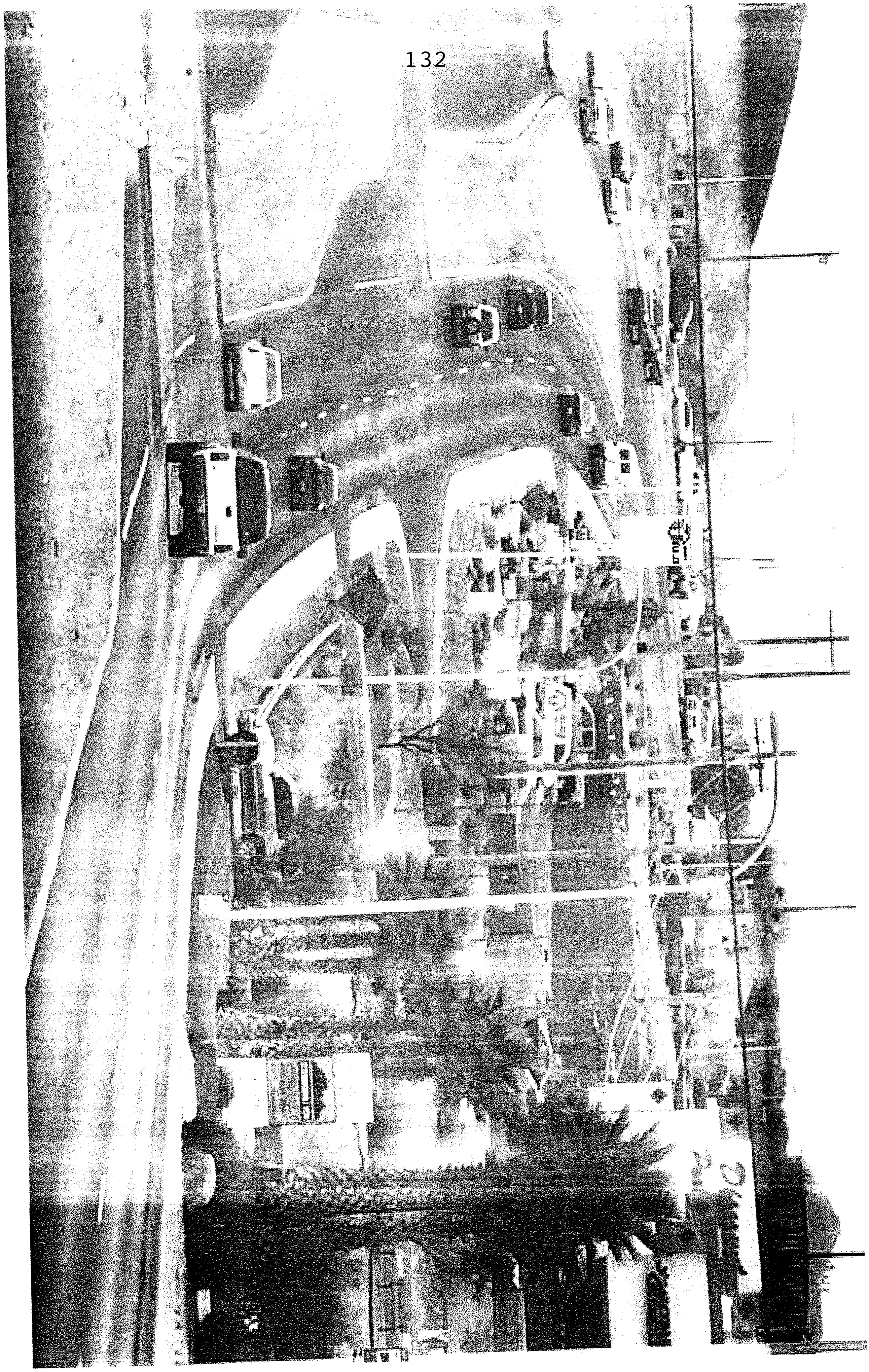
Equation #2: ***LH = (LN x 10 + LO) / (LI / 6)***

LH = (2 x 10 + 37) / (22 / 6)

LH = 57 / 3.67
LH = 15.5 inches

Table 3. Parallel sign letter height lookup table.

	Letter Height in Inches				
	Number of Lanes				
Offset from Curb (ft)	1	2	3	4	5
10	4	6	8	10	12
20	6	8	10	12	14
40	10	12	14	16	18
60	14	16	18	20	22
80	18	20	22	24	26
100	22	24	26	28	30
125	27	29	31	33	35
150	32	34	36	38	40
175	37	39	41	43	45
200	42	44	46	48	50
225	47	49	51	53	55
250	52	54	56	58	60
275	57	59	61	63	65
300	62	64	66	68	70
325	67	69	71	73	75
350	72	74	76	78	80
375	77	79	81	83	85
400	82	84	86	88	90



Attachment I

Attachmnt "B"

City of Las Cruces®

TO: Planning and Zoning Commission

PREPARED BY: Adam Ochoa, Associate Planner AO

DATE: September 22, 2009

SUBJECT: A1701

RECOMMENDATION: Denial

Case A1701: A request for a variance from the type of freestanding signage allowed in the Lohman Avenue Overlay District (LAO). The subject property is located at 115 Roadrunner Parkway and is subject to the LAO guidelines. In the LAO a ground sign is the only type of freestanding sign allowed with a maximum height of seven (7) feet and a maximum size of forty (40) square feet. The applicant would like to install a 20 foot tall elevated pole sign with a total size of 104 square feet. The sign will be used for the purpose of identification. The subject property is zoned C-3C (Commercial High Intensity– Conditional) and encompasses 1.72 +/- acres. Submitted by Carrie Swartz, Swartz Investment Group LLC on behalf of property owner Gary Anderson.

BACKGROUND

The subject property encompasses 1.72 +/- acres and is the current location of a business/shopping center. The applicant is requesting a variance of thirteen (13) feet to the maximum allowed sign height of seven (7) feet in the Lohman Avenue Overlay District (LAO) and a variance of sixty-four (64) square feet to the maximum allowed size of a sign of forty (40) square feet in the LAO. The proposed sign will initially only advertise the business of the applicant, but with the requested increase in the size of the sign, the sign would have the ability to expand to allow other businesses in the business/shopping center to advertise on it as well.

The applicant has stated that the sign will be used to help identify the businesses in the shopping center that cannot be easily seen from the street. The applicant also stated that the property has a dramatic grade change, physical barriers, an abnormal terrain, and road and building obstacles that inhibit some of the businesses on the property from being seen by potential customers. The applicant goes on to state that an elevated pole sign will be much more easily noticed from the street than any type of attached signage placed on the walls of the buildings that are very difficult to see from the street. The applicant has also stated that utility service boxes on the property would block a ground sign from being seen properly from all directions. The proposed sign would be located at a location on the property where it can easily be viewed from all directions of the street. The applicant concludes by stating that the proposed new sign will be installed a minimum of five (5) feet away from the front property line in the landscaped area of the subject property and that the sign will have a textured stucco skirting around the support pole that will match the buildings on the property.

On April 28, 2009 the applicant requested a similar variance from the Planning & Zoning Commission for a sign that would only advertise the applicant's business in the business/shopping center. The applicant later withdrew the request to review the possibility of adding the other businesses on the subject property to the proposed sign so that every business would have the opportunity to use the sign. The new proposed sign would initially only have the applicant's business displayed on it, but later additional space would be made available for other businesses in the shopping center to be identified. The initial sign will be 54 +/- square feet in size and the sign would later grow to the requested size of 104 square feet when other businesses in the shopping center invest into the sign.

The subject property is zoned C-3C (Commercial High Intensity – Conditional). One of the conditions placed on the property's zoning is that it must follow the Lohman Avenue Overlay District guidelines. Article 5, Section 38-47 B of the Zoning Code states that in the Lohman Overlay District freestanding signage will be limited to monument/ground signs for properties located east of Nacho Road. Monument/ground signs in this area shall have a maximum height of seven (7) feet and a maximum of forty (40) square feet in area.

FINDINGS

1. The subject property is zoned C-3C (Commercial High Intensity – Conditional).

2. The subject property is subject to the Lohman Overlay District guidelines.

3. The Lohman Overlay District limits Monument/Ground Signs to a maximum height of seven (7) feet and a maximum of forty (40) square feet in area for properties east of Nacho Road.

4. Adjacent land use and zoning include:

	Zoning	Land Use
North	C-3C	Commercial
South	C-3C	Commercial
East	R-1a	Vacant
West	C-3C	Commercial

5. The criteria, as defined in Article 2, Section 38-10 of the City of Las Cruces Zoning Code used to identify a hardship are as follows:

   - A physical hardship relative to the property (i.e., topographic constraints or right-of-way takes resulting reduced development flexibility, etc.) in question.
   - The potential for spurring economic development at a neighborhood or city-wide level if requested allowances are granted.
   - Monetary considerations not as a whole, but relative to options available to meet the applicant's stated objectives when such options cause considerable monetary hardship under strict application of code provisions.

RECOMMENDATION

Staff has reviewed this variance request and recommends **DENIAL**, based on the preceding findings.

OPTIONS

1. Approve the variance request.

2. Approve the variance request with conditions determined appropriate by the Planning and Zoning Commission.

3. Deny the variance request.

   NOTE: Decisions must be based on "findings". The findings presented in this document can be used to support **APPROVAL** decisions only. Other findings may be based on the Comprehensive Plan, Zoning Code, or other City plans and policies. Findings may also be based on information presented at public hearings, information obtained through site inspections, etc.

The Planning and Zoning Commission has final authority on variance cases unless the variance cases are appealed to the City Council.

ATTACHMENTS

1. Applicant's development and justification statement
2. Site Plan
3. Applicant's narrative and supporting documents
4. Aerial Map
5. Case-related Sections of the 2001 Zoning Code, as amended
6. Vicinity/Zoning Map

Attachmint 1

DEVELOPMENT STATEMENT
For Variance Applications
Please print legibly or type

Please note: The following information is provided by the applicant for information purposes only. The applicant is not bound to the details contained in the development statement, nor is the City of Las Cruces responsible for requiring the applicant to abide by the statement. The Planning and Zoning Commission or City Council may condition approval of the proposal at a public hearing where the public will be provided an opportunity to comment.

Applicant Information:

Applicant's Name: Swartz Inv. Grp LLC; DBA Fox's Pizza Den

Contact Phone Number: 575-640-3261

Contact email address: SIGLLC575@COMCAST.NET

Website Address (if applicable): Fox's Pizza Las Cruces.com

Proposal Information:

Attachment A

Location of subject property: 115 Roadrunner Pkwy (corner @ Foothills)
(In addition to description, attach a map. The map should be at least 8 ½" x 11" in size and clearly show the relation of the subject property to the surrounding area.) LOT 5B Sombra De Colores; no16 Sec 9; T.23S., R2E, NMPM of USGLO Surveys

Current zoning of property: C3 Acreage of subject property: 1.7218 [includes 111 Roadrunner]

Type of variance(s) proposed: Elevated sign and increased max square footage

Required standard (for example, 15 foot rear yard setback): Lohman Overlay District. sec 38-47 B5 Signage. Ground monument ≤ 7 feet high and 40 sq. feet max

Request (for example, 12 foot rear yard setback): 20 foot elevated sign; Max ~~heigh~~ square footage 104 sq. ft. Setback from utility easement 2 ft.

Reason for requesting variance (hardship):
Physical Barriers & Constraints
Abnormal terrain; obsticles of the Road,
Building site abnormalities
& Road Safety (Driver safety)

Proposed square footage and height of structures to be built (if applicable): (Use separate sheet if necessary.) Attachment ~~A~~ B & C
~~max bar~~ Sign Height 20ft (from grade parallel / sidewalk)
Sign Sq. footage 104 ~~8x13~~
8ft wide x 13 ft height

Will any special landscaping, architectural or site design features be implemented in the proposal (for example, rock walls, landscaped medians or entryways, or architectural themes)? If so, please describe and attach rendering if available: Existing Rock Landscapping

Sign borders textured & painted to match buildings.
Sign Pilar ~~co~~ stucco & painted to match buildings.

Attachments

Please attach the following: (*indicates optional item*)

- location map
- detailed site plan
- *proposed building elevations
- *renderings or architectural or site design features
- *other pertinent information

Variance Fees

Revised through adoption of Resolution 00-360

Process	Fee
Single Family Residential Homeowner	$75.00
All other Variance Applications	$175.00
Appeal to City Council	$200.00

VARIANCE REQUEST
JUSTIFICATION STATEMENT

Please provide information on the following issues. This information shall serve as justification for your variance request to the Planning and Zoning Commission. Please note that the Planning and Zoning Commission will thoroughly review the information provided and consider it when making a decision. If the information you provide is unreadable or unclear, it will not be accepted by the Community Development Department (CDD). Additional sheets of paper may be attached.

1. Please explain the nature of your variance request, including the specific numerical request. Attachment D1-D6
Building site & Road (Roadrunner) physical attributes & clear site triangles inhibit sign visibility & effectiveness based on Lohman Overlay district. Adherence to current code restrictions is unsafe for Driver Regcognition. No other road section in overlay district contains all these obstecles (or severity) at the same time. Request 20ft elevated sign 104 sq. ft. 2 ft. from utility easment. North side of Roadrunner entrance.

2. Please explain what physical constraint(s) exists on your property that makes it impossible for you to follow the regulations as written. Attach additional sheet(s) if necessary.
The section of RoadRunner Pkwy from Lohman to foothills has a dramatic curve & grade. ust 111 & 115 RoadRunner property line drops ~30 ft. in 150 linear ft. North bound RoadRunner has between 30 & 40° curve & large median. Additional Barriers consist of depression of parking lot & building betweens 5-15 ft. from Road height (South bound) Placement of utility service boxs at Northeast Corner and clear site triangles because of surrounding streets & entrances also impose additional Physical Barriers.

The Planning and Zoning Commission is a seven member, City Council appointed, volunteer board whose job entails making decisions on variance requests and staff interpretations on appeal. A variance is a variation in the numerical requirements of the Zoning Code. A staff interpretation appeal occurs when an applicant disagrees with an interpretation of the regulations made by CDD staff. In that case, the applicant may appeal staff's decision to the Planning and Zoning Commission. All decisions of the Planning and Zoning Commission are based on the following criteria:

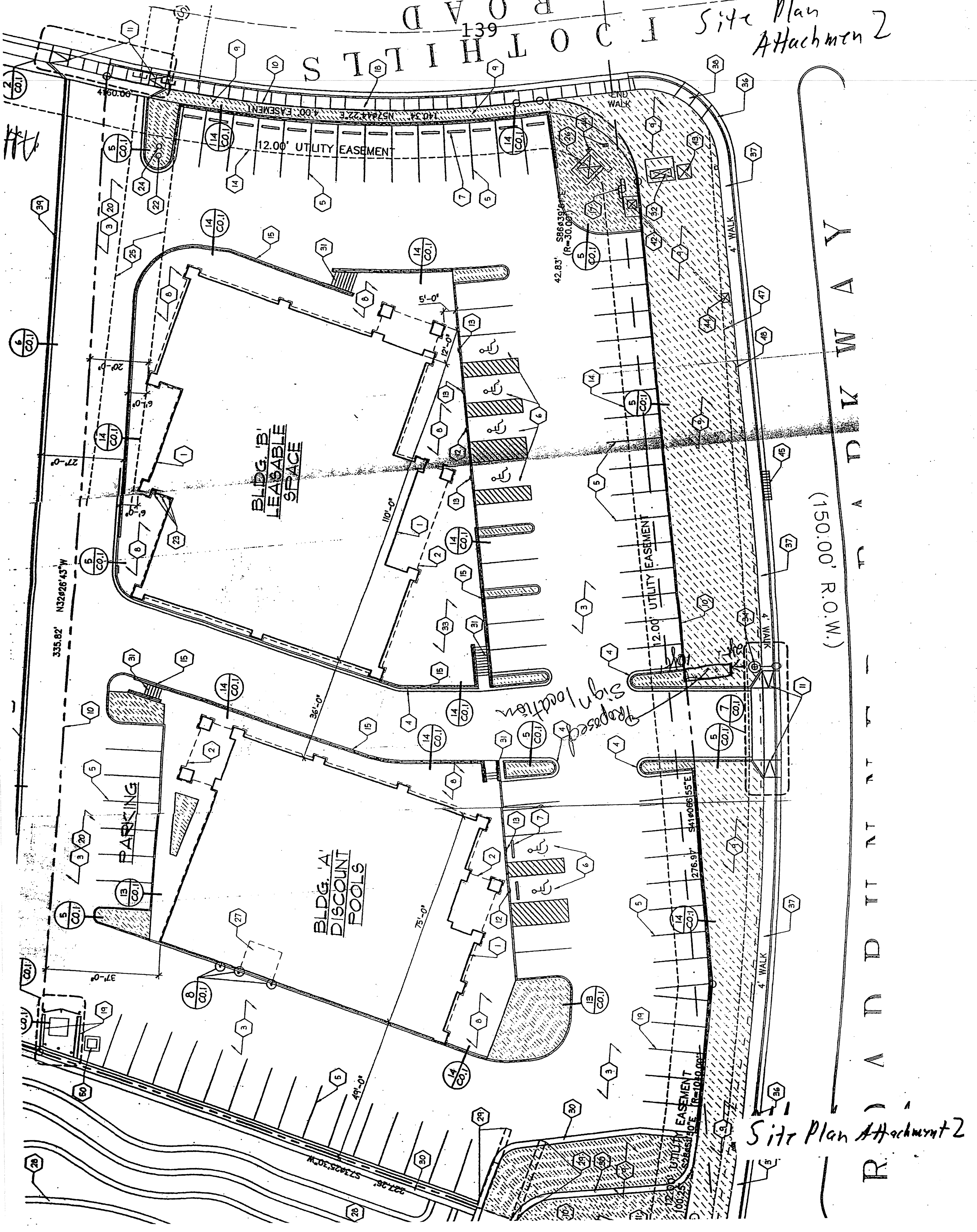
a) The general harmony your request has with the intent and purpose of the Zoning Code, which is to encourage the most appropriate use of land and to promote the health, safety, and general welfare of the community.

b) The effect of your request to adjoining properties. A variance will not be granted if adjoining properties are adversely affected.

c) The impact your request will have on the supply of light and air to adjacent properties, the increase of danger of fire, the endangerment to public safety and the impact on established property values. Variances shall not be granted if any of the aforementioned are increased or negatively impacted.

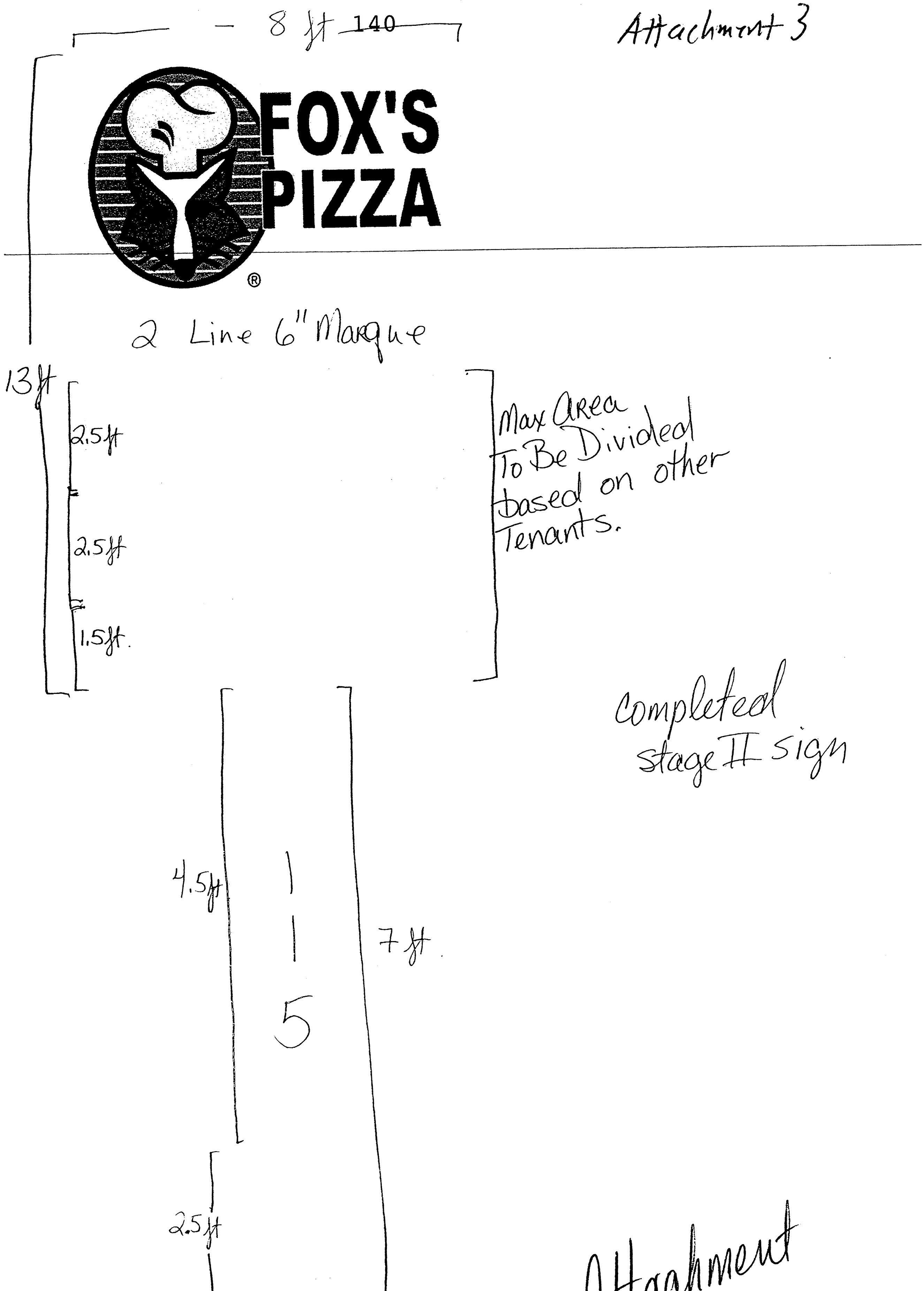
Site Plan Attachment 2

139

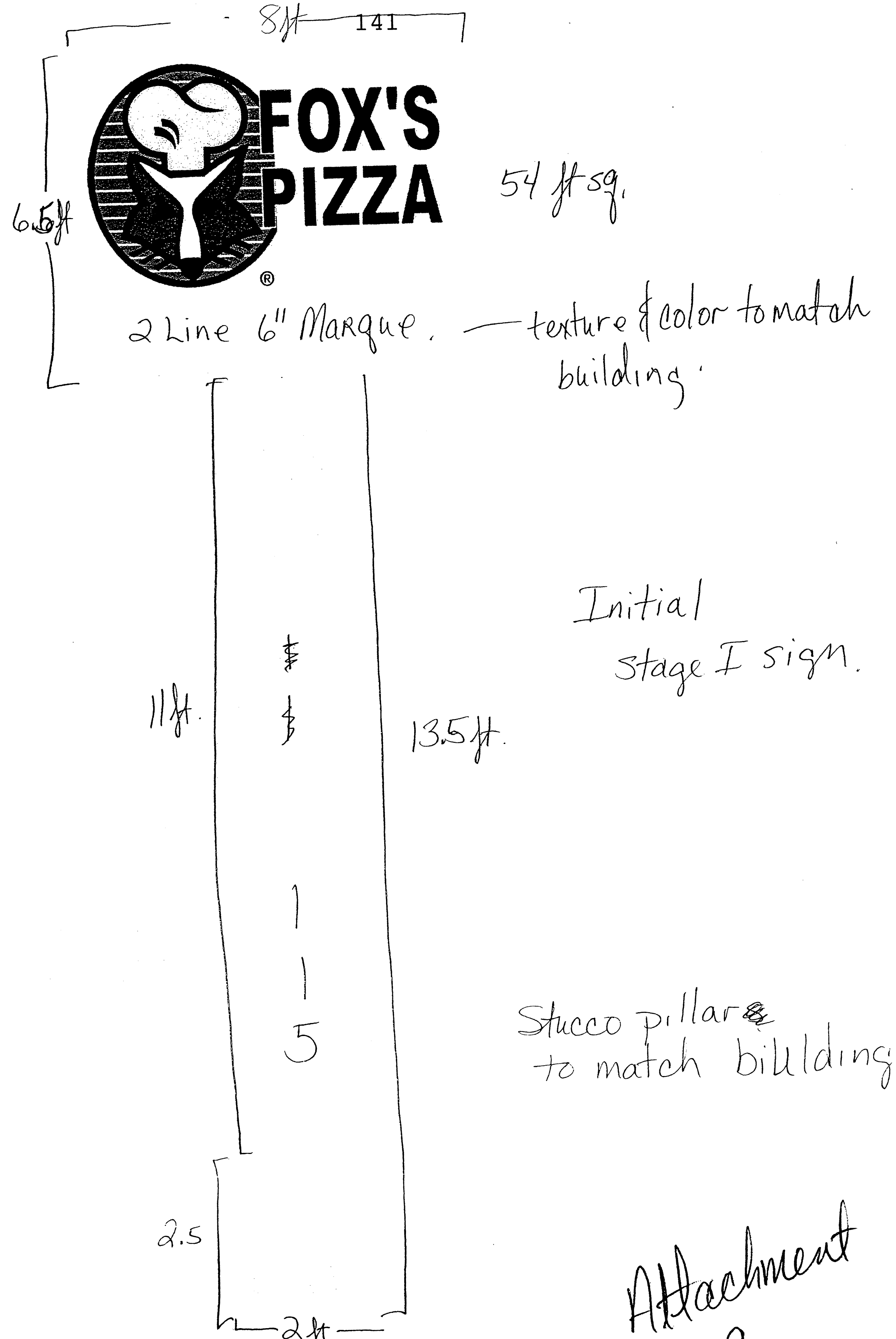


Site Plan Attachment 2

Attachment 3

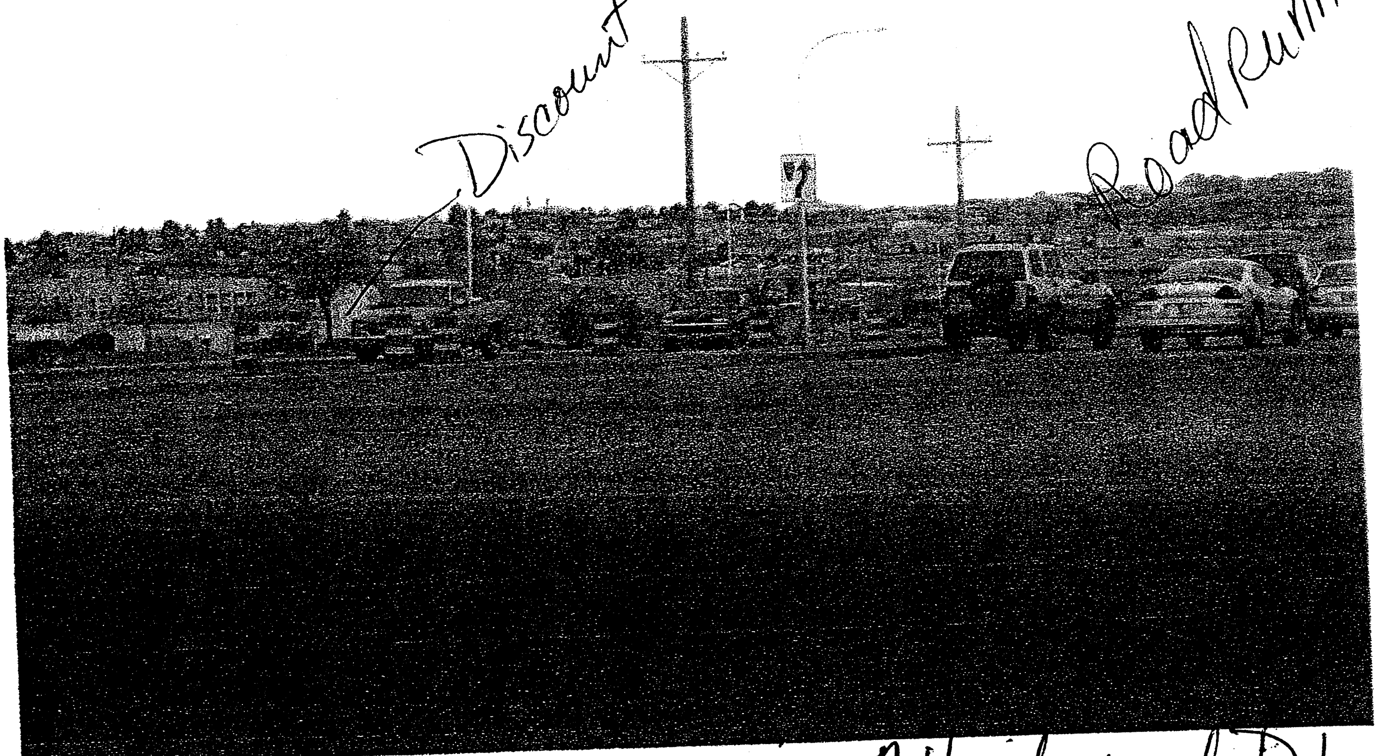


Attachment B

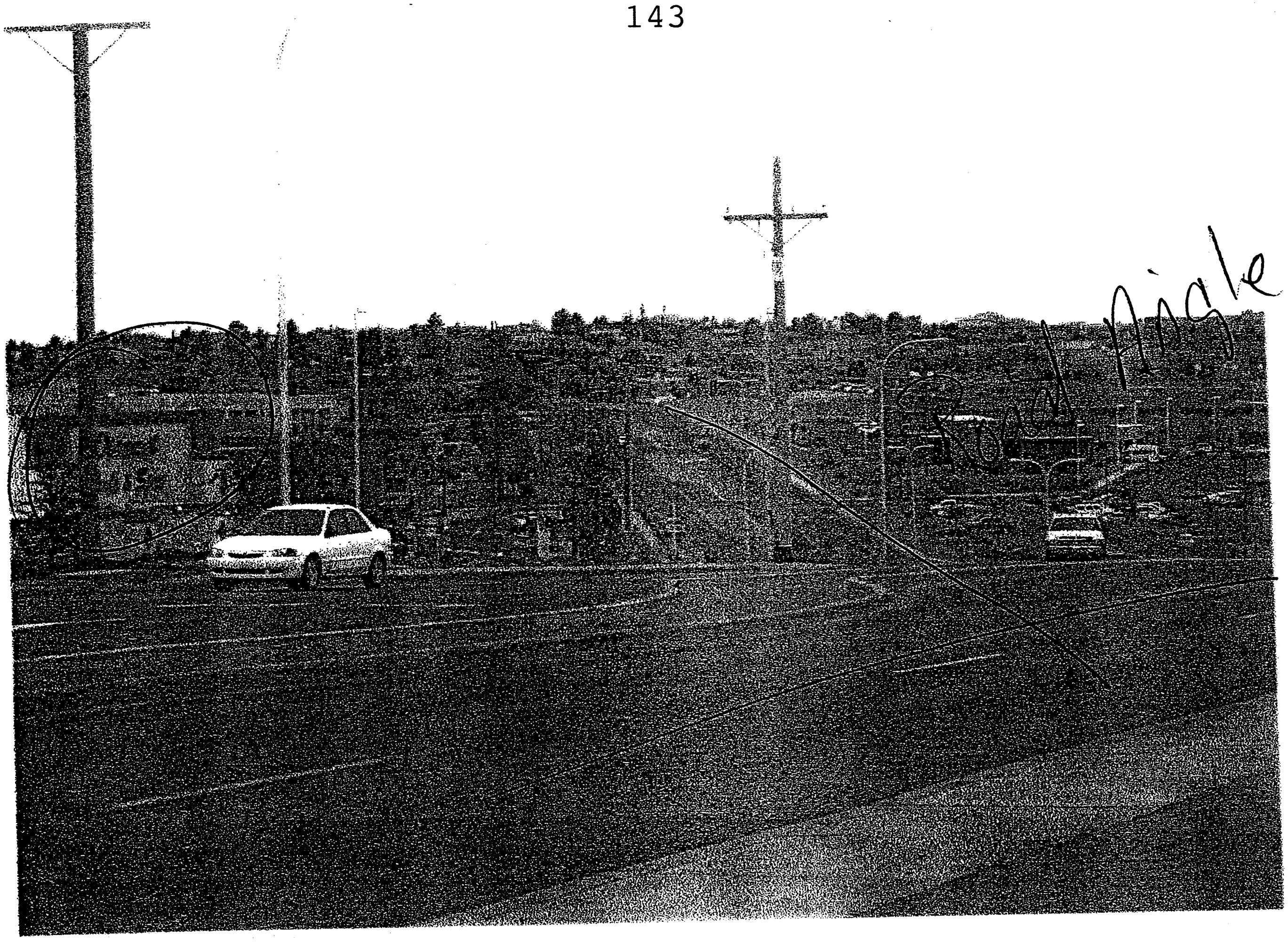


Attachment C

Lohman/Roadrunner Intersection.

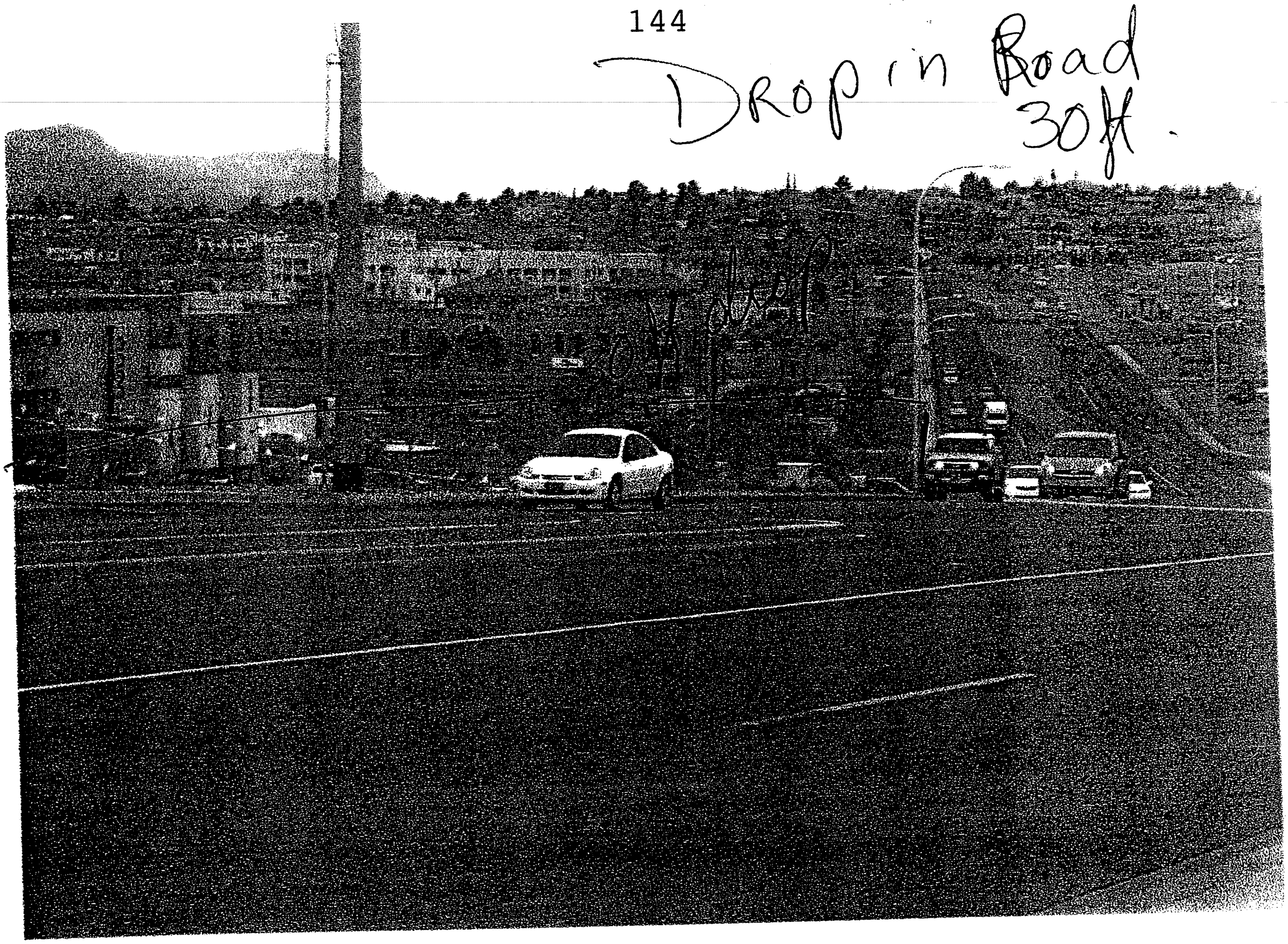


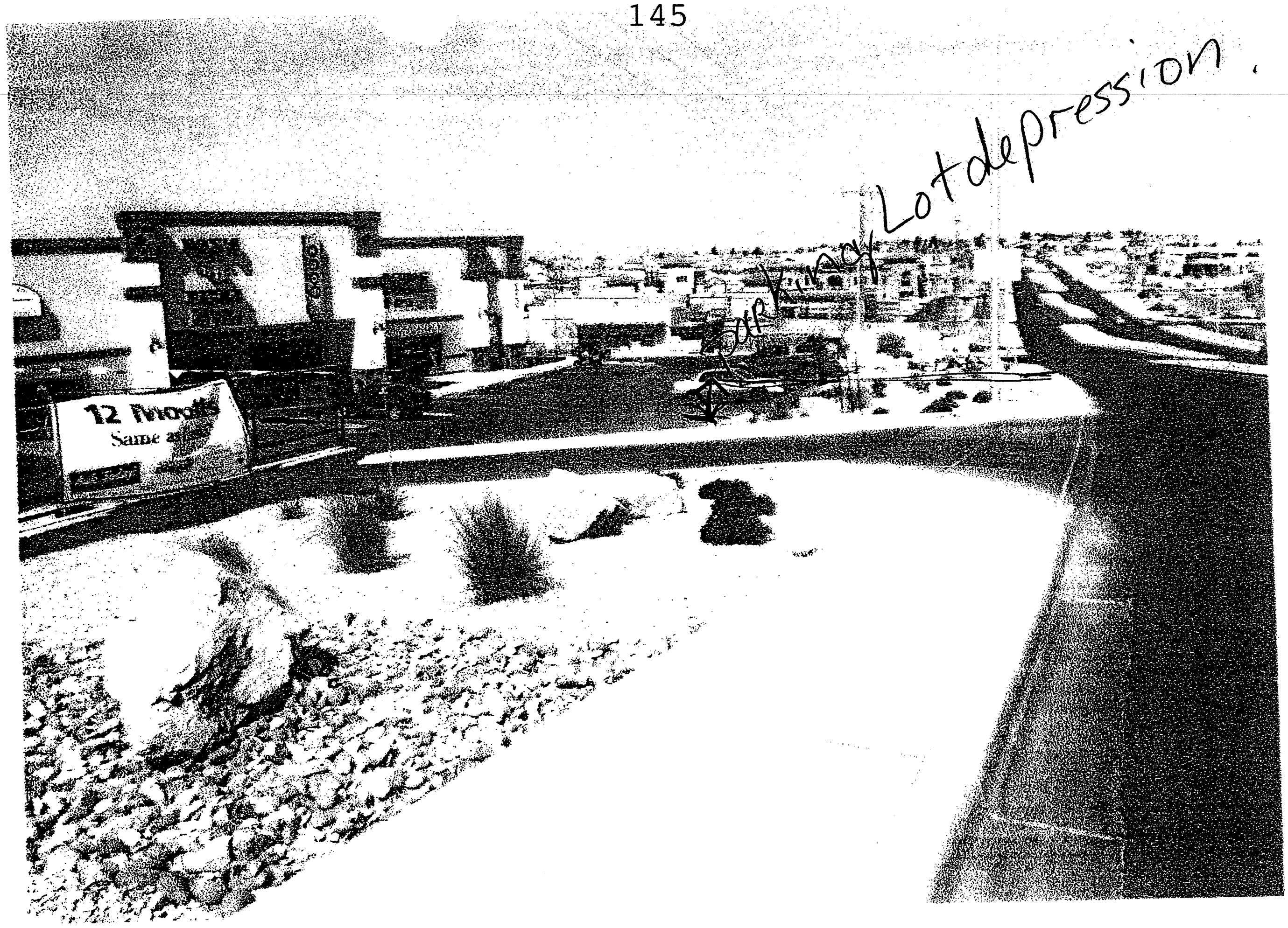
Attachment D1


Road Angle


Road Angle infront
of I15 Roadrunner

Drop in Road
30ft.





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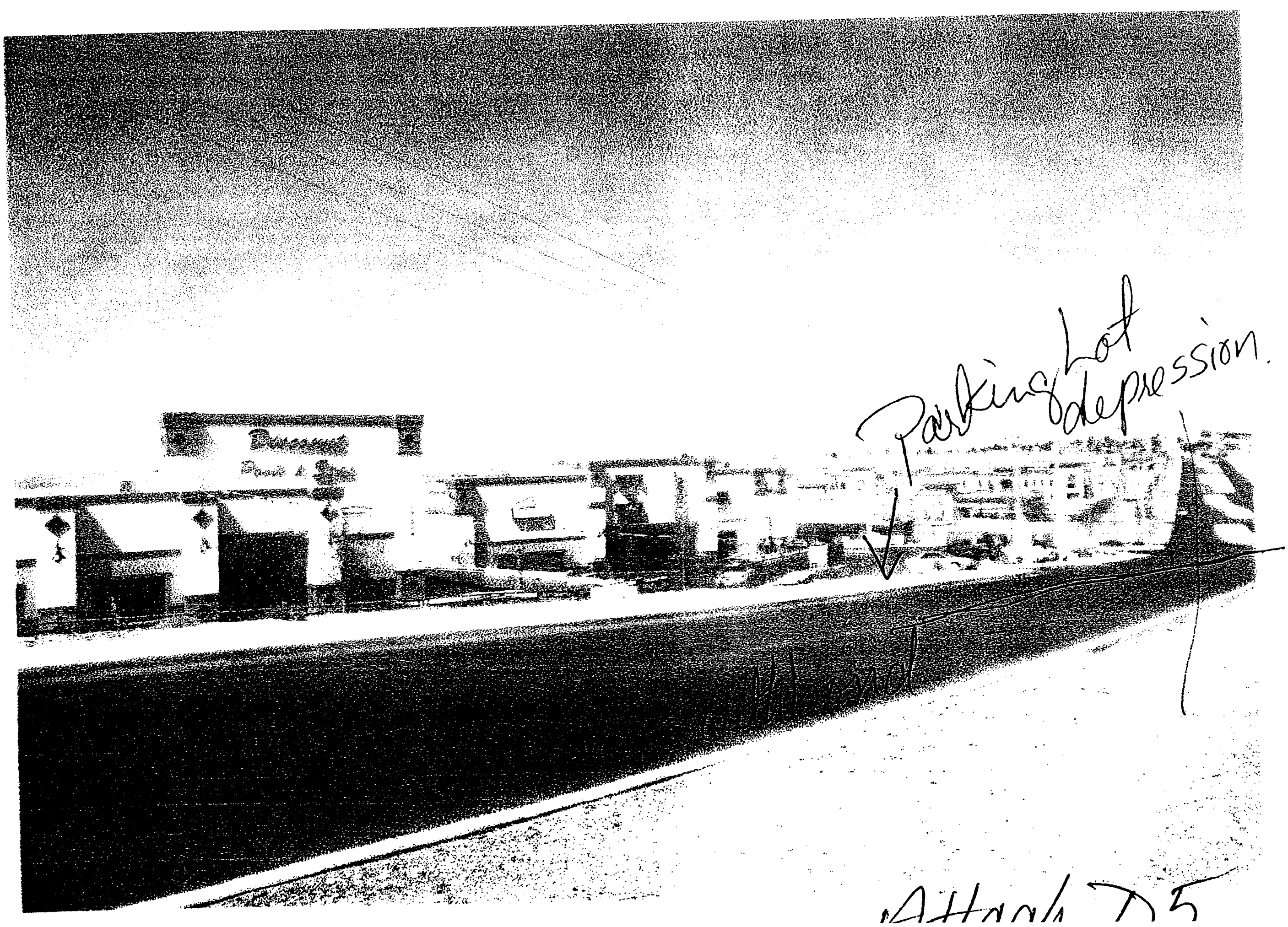

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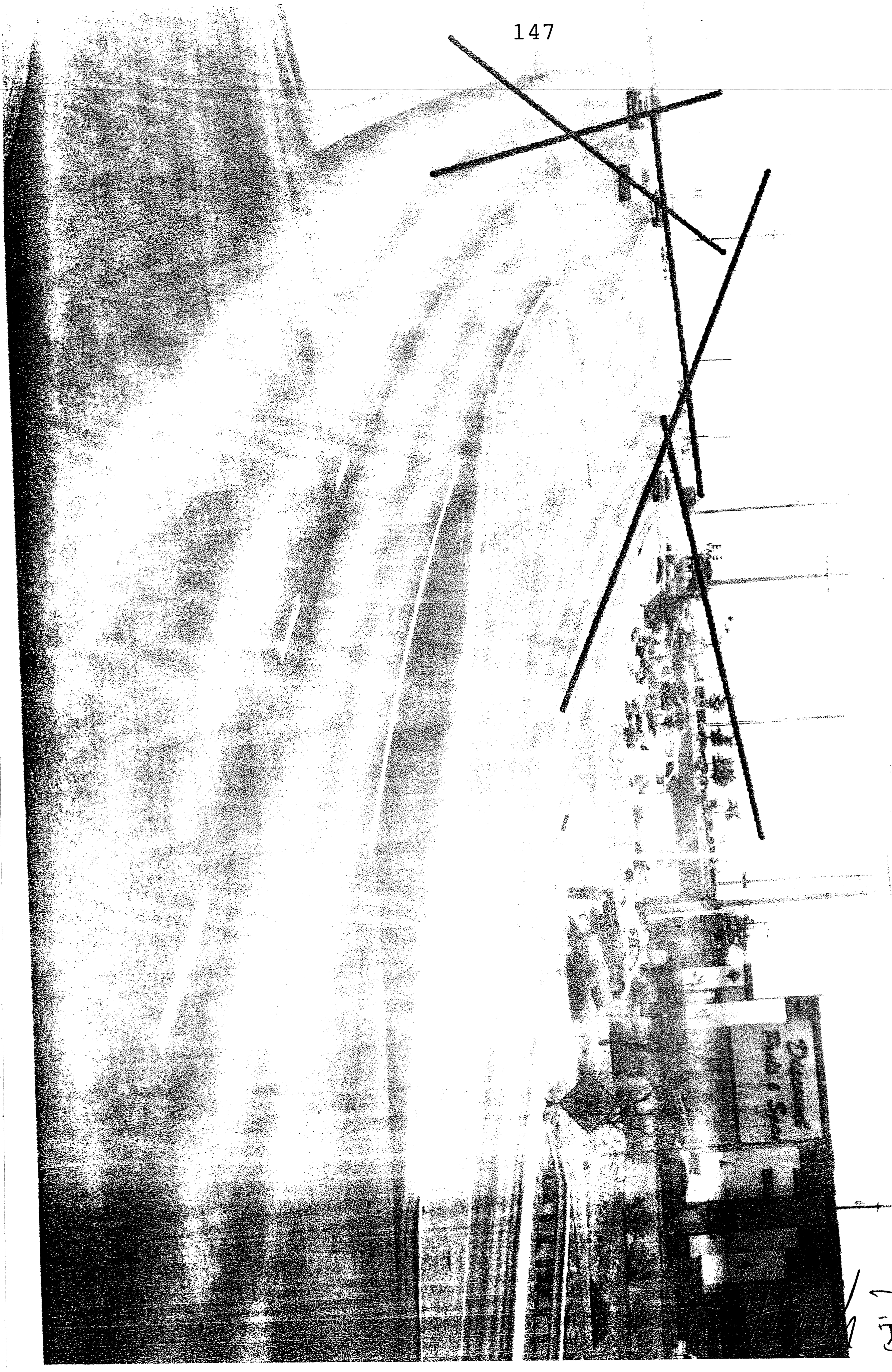

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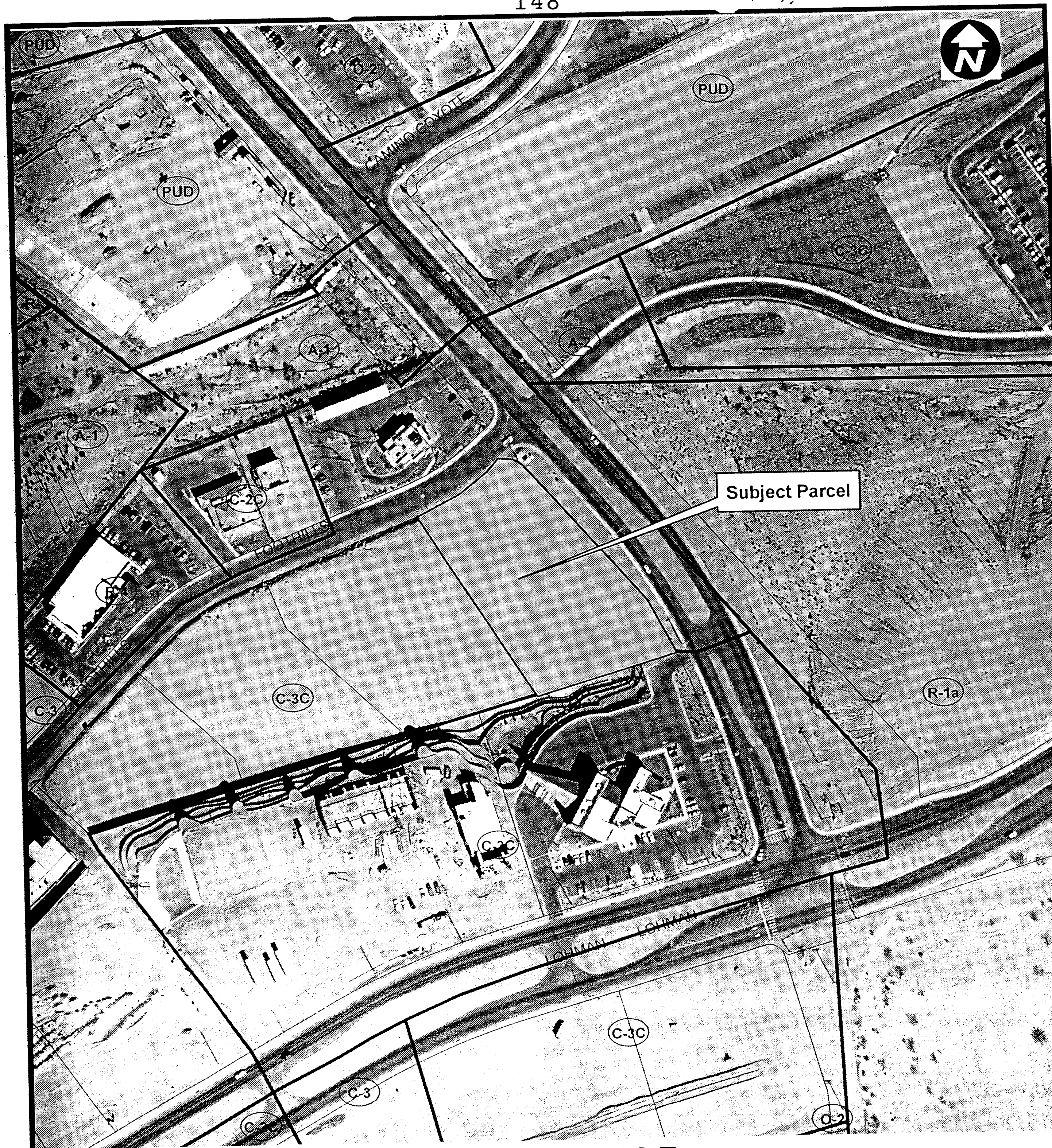


AERIAL MAP

CASE NO. A1701
PARCEL: 02-34032
OWNER: GARY K & ROBIN L ANDERSON
ADDRESS: 115 ROADRUNNER PKWY
ZONING: C-3C

0 75 150 300 450 600 Feet

This map was created by Community Development to assist in the administration of local zoning regulations. Neither the City of Las Cruces or the Community Development Department assumes any legal responsibilities for the information contained in this map. Users noting errors or omissions are encouraged to contact the Community Development Department at (505) 528-3043.

Community Development Department
575 S Alameda Blvd.
Las Cruces, NM 88001
(505) 528-3222

i. Where possible, agreements to share driving aisles and parking areas to minimize traffic conflicts, lessen visual clutter, and promote greater traffic circulation efficiency are encouraged. Agreements may be made with adjoining property owners regardless of each business' hours of operation. Those seeking shared driving aisles and parking areas must observe the following:

1. Agreements shall be approved as to form and content by the City Attorney's Office and once completed, filed with the Doña County Clerk's Office.

2. In combining parking requirements, one hundred percent (100%) of the required off-street parking for all subject businesses shall be met.

3. For a businesses that is sharing parking in order to meet parking provisions, the agreement shall pertain to no more than forty percent (40%) of the number of parking stalls they are responsible to provide. The remaining sixty percent (60%) must be provided on that business' site.

j. The final site plan for commercial, office, and/or residential complexes must be approved by the Planning Director or designee. Complexes designed in a traditional "strip" fashion are prohibited.

(5) *Signage.*

a. Freestanding signage will be limited to monument/ground signs for properties located east of Nacho Road. Monument/ground signs in this area shall have a maximum height of seven (7) feet and a maximum of forty (40) square feet in area. Monument/ground signs are required to incorporate a landscaped base into its design. Monument/ground signs shall be placed no closer than five (5) feet from the property line and must not violate clear-sight-triangles. The number of freestanding signage shall be determined according to Chapter 36 of the Las Cruces Municipal Code, as amended. All other freestanding signs, i.e., those west of Nacho Road, shall comply with Chapter 36 and item b and c of this Section.

b. Billboards shall not be permitted.

c. Signs shall be designed (shape, color, and material) in a manner consistent with the building(s) to which it/they relate via the following:

1. Design elements and/or finish treatments such as stucco or brick surfacing, freestanding wall designs/treatments, etc., shall be incorporated into a monument/ground signs overall design. The

color of surface or finish materials used on the building shall be incorporated into the sign's supporting structure.

2. When multiple monument/ground signs are allowed, the design of each sign shall maintain a similar design appearance, and colors and lettering styles shall remain consistent.

d. Attached signage shall follow the requirements as established in Chapter 36 of the Las Cruces Municipal Code, as amended.

C. NONCONFORMING USES.

1. Definitions

The following words, terms and phrases, when used in this Chapter, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Exterior remodel, renovation, or alteration means any change or rearrangement in the supporting members of an existing building, such as bearing walls, columns, beams, girders, as well as any change in rooflines, or any enlargement to or diminution of a building or structure, whether horizontally or vertically. Normal maintenance activities as verified by the City's Building Official or designee are exempt from this definition.

2. Applicability

The following nonconforming use provisions in this chapter shall apply to properties within the Lohman Avenue Overlay District. Provisions pursuant to this subdivision which allow increases in floor, building, or lot square footage shall not abrogate minimum compliance requirements (e.g., parking, landscaping, and drainage) established elsewhere in this Chapter or in other companion codes.

3. Nonconforming urban design features

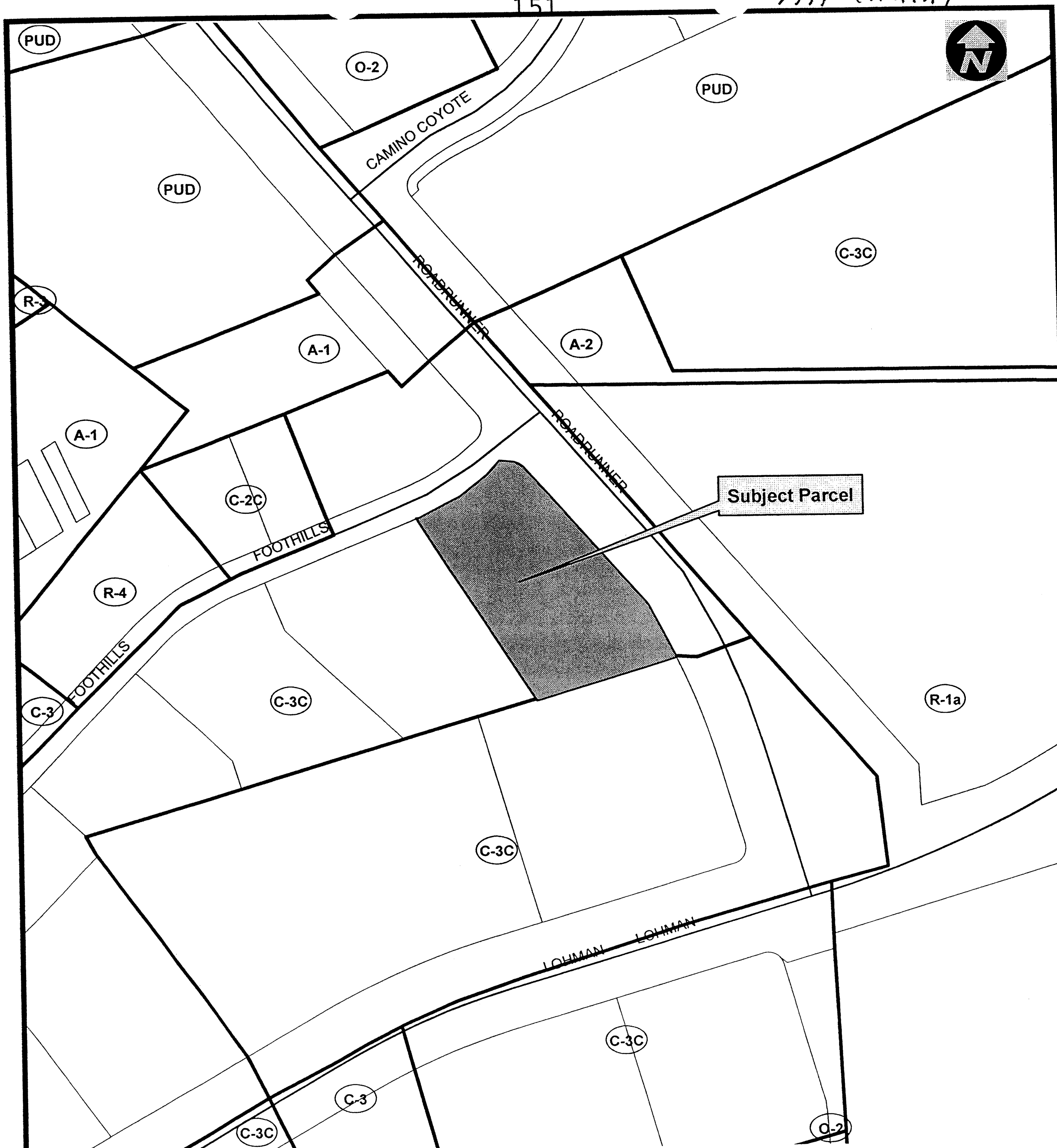
(a) When nonconforming urban design features involving parking, landscaping, lighting, and fencing/walls are located on properties within the Lohman Avenue Overlay District, these features shall be brought into compliance with Gateway standards when:

(1) The property remains vacant for a period of one (1) continuous year or greater;

(2) Any one-time or cumulative increase greater or equal to ten percent (10%) to the gross square footage of building area occurs;

(3) Any exterior remodel, renovation, or alteration occurs to the building. This provision shall not nullify allowances as identified in subsection (a) (2) of this section; or

Attachment 6



VICINITY MAP

CASE NO. A1701
PARCEL: 02-34032
OWNER: GARY K & ROBIN L ANDERSON
ADDRESS: 115 ROADRUNNER PKWY
ZONING: C-3C

0 75 150 300 450 600 Feet

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Attachment "C"

VI. OLD BUSINESS - NONE

Scholz: And there is no old business as far as I can see.

VII. NEW BUSINESS

1. **Case A1701:** A request for a variance from the freestanding signage allowed in the Lohman Avenue Overlay District (LAO). The subject property is located at 115 Roadrunner Parkway and is subject to the LAO guidelines. In the LAO a ground sign is the only type of freestanding sign allowed with a maximum height of seven feet and a maximum size of 40 square feet. The applicant would like to stall a 20-foot tall elevated pole sign with a total size of 104 square feet. The sign will be used for the purpose of identification. The subject property is zoned C-3c (Commercial High intensity- Conditional) and encompasses 1.72 +/- acres. Submitted by Carrie Swartz, Swartz Investment Group LLC on behalf of property owner Gary Anderson.

Scholz: All right, let's try new business, Case A1701, request for variance on a sign. And Mr. Ochoa. Nice to see you.

Ochoa: Good to see you sir.

Scholz: By the way, I should mention that the way we pursue this is the city presents the case, then we allow the applicant to speak, then we ask for public comment, we close for public comment, the Commissioners discuss it, and then we take a vote. Okay. Lay it on us.

Ochoa: Good evening gentleman. Adam Ochoa, Community Development for the record. Case A1701 is a request for a variance from the type of freestanding signage allowed in the Lohman Avenue Overlay or LAO for short, for a property located at 115 Roadrunner Parkway. It's submitted by Carrie Swartz from Swartz Investment Group LLC on behalf of property owner Gary Anderson.

Code requirements for this case tonight gentleman, its Article V, section 38-47B, it's the sign regulations for the Lohman Avenue Overlay District, basically states that freestanding signage will be limited to monument and ground signs for properties located east of Nacho Road, which this property is. Monument and ground signs in this area shall have a maximum height of seven feet and a maximum of 40 square feet in area. The property is zoned C-3c commercial high intensity - conditional. Basically one of the conditions placed on the property is that the property must follow the Lohman Avenue Overlay District guidelines. The subject property is current location of a shopping/business center. The applicant is requesting a variance to allow the installation of an illuminated elevated pole sign, with skirting by the way. The proposed sign will be a total of 20-

feet tall with a total size of 104 square feet. The applicant has stated that the sign will eventually be used to identify most of the businesses in the shopping center that cannot be easily seen from the street or all that cannot be seen from the street. The applicant goes on to state that the property has dramatic grade change, it has physical barriers, abnormal terrain, and road and building obstacles that inhibit some of the businesses from being seen by potential customers on the street. The applicant has also stated that utility service boxes and landscaping on the property would potentially block a ground sign from being seen properly from all directions on the street.

The applicant believes that the elevated pole sign would be noticed much easier than any other type of attached or freestanding signage, and the proposed new sign would start off with just the business of the applicant being advertised on the sign, but the sign would eventually have the ability to increase in size to allow other businesses in the complex to use the sign as well. By that I mean this would be stage one for the proposed sign. Like I said the applicant's business would be the sole business on the sign, height of 20-feet tall and 54 square feet in size. And stage two would basically, same height of the sign, but it would be a total of 104 square feet, allowing the bottom part of the sign for other businesses in the shopping center/business center to advertise as well.

Here's a site plan of the property with the two buildings. The sign would be located about where the blue triangle is. The sign will meet the minimum setback for the Lohman Avenue Overlay of five-feet. Applicant has stated that it would actually also be outside of the utility easement which would push the sign back farther from the street. Here's a vicinity map of the subject property on the corner of Foothills and Roadrunner. Like I said it is zoned C-3c. Here are some site photos of the property. Top left corner that's a picture taken from north of the property, on the other side of the corner of Foothills and Roadrunner. Subject property is seen on the right. There are the utility boxes and landscaping in question that the applicant has stated would block a ground sign. Sorry, that was top left. Top right corner is a ...

Evans: I'm sorry, can we turn down the lights so we can see the displays better?

Ochoa: Will that work for you sir?

Evans: Yeah, that's better.

Ochoa: Top right corner, you will see basically it's taken across the street on Roadrunner. You can see kind of the grade change of the property. Bottom left hand corner you can see that picture was taken on the corner of Roadrunner and Lohman. Subject property with the buildings can be seen right back over here, that is the frontage right there of the property. And this one was taken right at the corner of the property itself, again with the property right in front.

Findings, staff has reviewed this variance request and has concluded that no valid physical hardship exists for the subject property. Staff recommendation for tonight is denial based on proceeding findings. Your options tonight gentlemen are 1) to approve the variance request; 2) to approve the variance request with conditions determined appropriate by the Commission, or 3) deny the variance request. That concludes my presentation. I stand for questions. Applicant and property owner are here for questions as well.

Scholz: Okay, questions for Adam? Thank you Mr. Ochoa. May we hear from the applicant please?

Swartz: Carrie Swartz from Swartz Investment Group. I'm the one who put in for the request for the sign variance. Some of these pictures that I have will be a little bit repetitive, but I'll go through those quickly. One of the things, and unfortunately this is not very good for reading, this is from the Transportation Research Board of the National Academy. Increasingly however the visibility of on-premise advertising signs is being determined not by human factors, researche's, visibility experts, or traffic engineers, but by local planning and zoning officials who lack specialized training in relevant fields. Regulations affecting on-premise sign visibility characteristics such as means of illumination, lateral off set, and sign size have been established mainly on the basis of arguments for improved aesthetic appeal and vague often unsubstantiated safety claims. This is the Lohman Avenue Overlay District and if you notice down here, this is pretty much Walnut; going up here this is Roadrunner, and right about here is where our property is seen. No where along this tract is there this same or the insurmountable physical barriers that our property sees.

According to the Lohman Avenue Overlay District, the whole purpose of the Avenue Overlay District is to specify architectural and urban design provisions to improve this important entrance in to our community and promote an attractive image for the city as a whole. Now, for some reason they think that from Nacho, this is Nacho Road, from Nacho Road on up is an entrance more so than from Nacho Road down. They state that the ... we've already done the free signage standing. They've gone over that. This is a picture from the corner of Roadrunner right here, and Lohman. You can barely make out Discount Pools which is approximately a little over a 100-feet from this corner, and you cannot make out anything else. If you also look you'll see the angle, I'm a little off because I'm not that good, okay. The angles of the drivers, the sight of ... the line of sight of drivers. This one goes this way. There is practically no way unless somebody does a 90-degree turn on their head that they see anything over here. Way over here I want to point out too a sign by Allstate, its six and a half feet by 13-feet. It's got two various businesses on it. Total square footage is 84.5 square feet. It's up, elevated over seven feet is when it starts. Here again is a picture of that sign, not obtrusive to the area.

Here again is that intersection with cars in the area. You cannot see anything. This is a picture of the property. Up here in the corner it starts at 92.6-feet, I don't know what exactly that means, it immediately travels down to 77-feet in the parking lot, which it continues to go down to 69-feet, compared to the 82 feet over here at the street level. And again this road here pretty much does a 90-degree angle right in front of this 150-foot area. And then here again you can see the angle, the traffic, visibility and here. The recognition here you can only see this sign and this sign, any other businesses here are not visible in either direction really, unless in this direction if somebody makes a big head turn and in this direction when people are going that way, unless they turn dramatically. Again, you can see the elevation change here from I think it was 82-feet down to 62-feet. Again, I'm showing that there are tremendous physical barriers to the visibility of this property that were not planned on when anybody made these rules. Same thing.

Here is a sign, Ross, its 12-feet by 11-feet, 132 square feet. It is east of Nacho Road, in fact it sits right on Nacho Road and apparently they had barriers. I don't know what barriers, but they had barriers to a ground monument sign. They also don't have signage for every establishment that is there. And again, there is their sign, but they needed it there because they wanted it to be seen by this intersection. Here is Old Navy, now I looked and I said oh darn it's not east of Nacho, but this is along the lines of what we're looking at putting in. Pleasant looking, simple. Here's another one, 166 square feet, again you see where one business has the majority of the establishment and other places small, and these little ones down here, that's equivalent to our 40-square feet for multiple businesses, can't be seen.

Walgreen's, didn't even have to put in a monument. Here, I'm sorry for the roughness, I'm not that artistic, roughness of the sign, this down here would not be put up initially, it would just be this part here. There would be a square pillar. It would be stuccoed and textured. This up here, all coloring would be done to be pleasing to site, but not obtrusive like the Ross sign was, very overpowering. It would blend in with the scenery. If you see my van here, this is an almost 20-foot van. This is roughly the size, give or take a hair, because I had used a measurement mark that was on this sign that's not there now. Here again, distance, this I think is a little too big for what it should be, but again if you look, now with it elevated it can be seen from all directions. And that's the end of my presentation. Any questions?

Scholz: Okay. Questions?

Crane: Mr. Chairman.

Scholz: Yes, Commissioner Crane.

Crane: If all the … I think there's five businesses in the building that Fox Pizza's in, right?

Swartz: Yes, sir.

Crane: There could be. If they all put up a sign, how big would your total sign area be. Or to put it another way, is everybody going to be able to have a sign the size of the Fox Pizza?

Swartz: Everybody would be on the one sign. The one sign … I have the largest portion of the sign, no different than Best Buy's, the other signs would come in and put in … this is approximately six and half feet by eight feet. This section. This is six and half by eight feet which in particular the businesses that don't have the visibility, the two businesses that have already gone out of business on either side of myself, and the one in back of me in particular, they would easily be able to put something here, and if we needed to add anybody else we could still split these possibly. We would have to look at the name sizes to see if it would still be viable. If not, if that would not be recognizable enough, I would volunteer to give that fourth business this space here.

Crane: And this is illuminated?

Swartz: It would be illuminated.

Crane: Fluorescent tubes inside.

Swartz: Minimal.

Crane: Okay. Thank you.

Swartz: According to the restrictions of the lights.

Crane: Thank you.

Scholz: Other questions?

Evans: Yes, Mr. Chair.

Scholz: Commissioner Evans.

Evans: Could you go back a couple of slides so I can kind of digest the size and the locations of some of the other signs in the general area?

Swartz: One of the one's that closest, this is 108, I'm looking at 104.

Evans: Right. Okay.

Swartz: This is a 132. This is just the signage area. This is not including the lipstick on the outside. And then it's difficult to see that one that's way back, this one right here, but if you've driven down the road, that one's 84.5, two businesses, 40 square feet each.

Scholz: Okay.

Evans: One other question. Could you go forward a couple slides? And right … you're looking at putting in your sign right there around 82?

Swartz: Yes, actually because this drops so dramatically it's probably three or four feet down here, because it drops really quick really fast.

Evans: Okay, it'll be at the 82 height level, similar.

Swartz: Yeah, somewhere in between.

Evans: Okay. And then, so continue on with your presentation … go down a couple of slides now. Okay. So how did you come up with your height?

Swartz: The height, one of the things I came up with is because of the size of the height, I gave seven feet underneath so that any vehicle that's coming out of this direction, if you notice the angle of this road, it comes this way. If you put something ground monumented there, close to the sidewalk, you're going to be blocking this road and the visibility and the traffic is going to be a problem. Because you've got people, although it's stated for 35, are going much faster than that and you'll have a big piece of monument there that they can't see through. So that's why I went for the seven feet up. Now, as far as the width of it, because we're working in such a very small area that we can work in because you have to be so far from the power lines, and so far from the road. That's why we're going for such a … not really wide. But it's going to be taller.

Scholz: Okay, did that answer your question Commissioner Evans?

Evans: Yes. And as I recall last time that you came, I think it was about three months ago or so.

Swartz: That is correct sir.

Evans: Was in April? We talked … that sign potentially on the corner and so I was wondering what your rationale was you know for moving it up to its current location you know where you have it planned now?

Swartz: Actually the location is the same location that I'd put in for before.

Evans: Right.

Swartz: Which the term corner may have been thrown out. I have never looked at going for this corner because of ... it makes sense as a business-wise and for visibility that you want to be seen by the closest populated intersection, and that would be this one up here. And by putting it in this location, it gives the most reasonable visibility both in this direction and this direction. I don't know if that makes sense. Maybe a little.

Evans: I understand where you want to put it. I guess I don't understand the rationale between ... if you put it down there on the corner similar to where like the Marshalls plan is, is kind of on the corner.

Swartz: Well the whole reason why they put it on that corner and the reason that they fought for that corner, let me find them again, is because they did not have any physical barriers. They wanted to be seen by this intersection over here.

Evans: Right.

Swartz: Okay. If you look at that and go back, there's nothing prohibiting a visible monument sign anywhere along there. None.

Ochoa: Just for the record gentlemen, the Laguna Seca shopping center which is what is in question, actually came in to existence before the Lohman Avenue Overlay, so that's why they got such a big sign. That's basically what it is.

Scholz: Okay.

Evans: Could you ... I'm sorry.

Scholz: No, go ahead.

Evans: So could you go back to that sign?

Swartz: This one?

Evans: Yes. So that sign kind of takes into account a lot of advertisement for the respective potential businesses on that whole section.

Swartz: For five of them.

Evans: Right.

Swartz: Not all of them.

Evans: Not all of them, but quite a bit. And I could see the need for this same type of advertisement space for the complex in which you currently reside in.

Swartz: Which is one of the reasons ... if you look right here, this is two foot right there. Each one of these is two foot. If you go back to the sign that I'm proposing, I mean I'll take more space. This is six and half so that gives ... if you divide it by three right now, then that's a little over two per by eight-foot, and that gives you at least ... anywhere from 10-20 inches of lettering that can go in there which according to the sign research and information I've been looking at, you know you want people to see you at least 100-150 feet because you need them to react. And it depends upon the speed and it depends upon the other conditions of the road. Obviously you've got to increase that for us, because of those factors on our road. So you're looking at anywhere from 10-22 inches depending upon which exact research you looked at or sign company or whatever. So that gives an ample amount of space, I think for at least three businesses there. And then like we said, if there needs to be the fourth one, then I would voluntarily give up that. But again it's given that just like Best Buys, Best Buy's is a cornerstone business for this area. This is one of the reasons why you see the larger sign for Best Buys, a small one for Staples, but they really, really gipped the other ones down below. They might as well not have even put them in there. I don't want to see that happen to my fellow businesses because we rely on each other. We've already had so many go out. We thrive on trying to help each other succeed.

Evans: Okay, thank you.

Scholz: Excuse me, Commissioner Shipley.

Shipley: Thank you Mr. Chairman. First of all, generally signs in commercial real estate business, the size of the sign is dictated by the principal people, in other words the large footprint ... in this case this is a regional shopping center. Best Buy is one of the largest stores in there so generally they get the space based upon the square footage. The larger square footage stores have space and then smaller square footage stores, because they have to pay for their portion of the sign, don't tend to take that much space. And that's done throughout the industry, not everybody gets a sign. Your shopping center is more of a neighborhood shopping center, is that correct? It's not a regional shopping center. You don't have any like

PetsMart, Best Buy, Staples, those kinds of stores.

Swartz: No, but I am part of a franchise over 300 stores long and nationally known.

Shipley: But your square footage in your store is about 1,200 square feet?

Swartz: Yes, sir, it is.

Shipley: Okay, their square footage in that store is probably close to 80,000 square feet or 100,000 square feet. And again that's why it's calculated that way.

Swartz: Well then I would say that their storage is slightly more than Staples, but they have double the size. They're not double the size.

Shipley: I understand.

Swartz: Okay. What I'm saying though too ... I understand your claim, but there is also the claim that there is certain cornerstone businesses, people think about food three times a day. They don't think about going to the dentist three times a day. So there's a difference in the type of sign you would have despite the amount of square footage they would have.

Shipley: Okay. The other comment that I wanted to make is that your business though is ... are you putting up a sign for the ... all of the buildings in the center, or are you putting it up for your business exclusively?

Swartz: Right now at this time there are no plans to put up a sign. There is a need for a sign and I am putting my money out there to start the sign and to get this process going. The other businesses, as they deem that they would like, can jump on board when they have the money and can do so. I will not charge them any extra than what it cost me to get the initial pole up. They will have to take their fair share.

Shipley: Okay. I guess the key is though that shopping ... the owner's of the center, you're leasing your space from someone, is that correct?

Swartz: Yes.

Shipley: Mr. Anderson.

Swartz: Mr. Anderson is right here in the audience.

Shipley: But generally the center is responsible for the signage of that center. In other words the Laguna Seca center, there was someone there that represented all the stores that produced that when they developed the shopping center.

Swartz: These are different times. This property has been wrought with tumultuous problems and we are going through recession and there are many other things. Mr. Anderson is not got that in the plans for right now. I can't wait. I need those things, so I'm volunteering to come forward … it's my money. It'll be his property.

Shipley: Okay.

Swartz: I don't see where that should be an issue.

Shipley: I don't have an issue with the sign. I'm just saying the signage should be built initially to house the center, to take care of the tenants that are in the center. And the reason I say that is because if you do piecemeal then somebody's going to come along behind you that may or may not … may have a bigger business than you have, may take up two or three spaces and then end up with less space or want a bigger sign or want an addition to the sign.

Swartz: But that is an issue for Mr. Anderson.

Shipley: Well it's an issue for us right now because we're planning for what's going to happen for here and now and in the future. So we're looking at, we're trying to look at this in a reasonable manner, given what guidance we've got as far as what the regulation is for the Lohman Avenue District. So when I … I drive up and down Roadrunner almost daily, multiple times daily, and I understand the way the buildings are situated on the lot they don't face the street, they face the opposite direction. Your entrance to your establishment which I frequent, is not facing the street, it's facing more towards the east than it is to the north. And so I recognize that. I also recognize that when you come down the street you have to make a U-turn to go back into your entrance to go into your store, unless you've lived there long enough and then you know to go down Foothills and then turn in the driveway and then come back around the building. So, Mr. Evans comment about putting the sign on a corner would do a couple of things; number one it would eliminate the people that doing a U-turn because they would see the sign in sufficient time to make a left turn onto Foothills and to go back around and that eliminates that problem. Because when people are making a U-turn they cut right in front of two lanes of traffic to get through there, as opposed to just going straight around the corner and crossing in front of that. So I kind of agree with putting the sign more on the corner. I also think that once … your shop is a destination shop pretty much, so most people if they eat three times a day and they want pizza they know where your place is after the first time they've been there. And when you drive by it you're not looking … you're not shopping for a pizza shop, you're just driving by and you see it and you stop. It is ... a seven foot sign is what the code requires now because of the Overlay District. And it would be nice to have that sign put in such a place as to make it accessible for all people to be able to see it and to react responsibly without having to turn or to do a U-turn in the street.

Swartz: How long do these people have to see the sign?

Shipley: Well they can see it from the top of the street.

Swartz: It's 30 feet.

Shipley: They don't need to see it at the corner.

Swartz: No, they don't see it from over here because the angle that they're going.

Shipley: There is no sign there now, that's what I'm saying. If you put the sign down on the corner so it can be seen so it's perpendicular to the street, as they're coming down the street they're going to look to see that intersection and they'll see the sign on the left. If they're coming up the street, there's no problem because it sits up above them, it's high, but it's at ground level. It's seven feet high. So it's ... the question is, is from that sign how do they get to your place, that's what you're trying to say I think.

Swartz: Okay. Here they are coming down that's barely the ...

Shipley: And they don't need to see ...

Swartz: Barely the top of an already existing item on the corner.

Shipley: Box. Right. But from that point ...

Swartz: And from this distance to over there.

Shipley: Okay, but at that point you're almost up by the traffic light at Roadrunner and Lohman.

Swartz: I am about 20-feet from the traffic light, from the corner, which there's maybe 80-100 feet between that corner and the start of this property.

Shipley: Okay, but ...

Swartz: Where as if we put it here ...

Shipley: You can't make a turn until you get to the intersection of Foothills.

Swartz: Correct.

Shipley: Okay, so that's not … that's how many feet? That's probably, what 400 feet, 600 feet?

Swartz: This property is only 150 feet long.

Shipley: And the other property on the corner …

Swartz: Is maybe 80.

Shipley: Okay.

Swartz: It's the perspective. It's a big perspective. If you have the sign up sooner, then they know to turn later. You know if that's the case then it should be up here. You know you're talking about just this direction here.

Shipley: No, I'm talking about both directions. It's a one way street going to the west, until you get down to Foothills. There's no place to make a turn in until you get to Foothills.

Swartz: That is correct.

Shipley: And then you have to do a U-turn and go back to the east and then make a right turn into … to get to your establishment and then you make another right turn as you're going down the hill in the parking lot.

Swartz: I think you're assuming most people think there's only one entrance in and out of a shopping center.

Shipley: No, there's got to be at least two.

Swartz: And most … thank you. So why do they think they have to go there when the whole shopping center is right there?

Shipley: Because that's what I see people doing. I see people turn to go … coming down the hill, make a U-turn, go back up, turn and go down the hill and turn to the right to go to your establishment.

Swartz: You probably have 50/50 maybe. I'm not sure. You know I can't account for people's logic. I really can't.

Shipley: No, I understand.

Swartz: And nobody can. And I would argue and I think we would both have good arguments to say whether this is a better spot or this one is, but this one is already succumbed with many items here. Initially Mr. Anderson had plans, see where my van is, because of all the rules and regulations, he ended up spending a fortune on a pad over here for a ground monument sign that nobody would have ever seen, because you wouldn't have seen it behind my van. So this is plumbed for electricity right over there right now.

Scholz: Ma'am, excuse me just a moment. Do you have any other questions Commissioner Shipley?

Shipley: I don't.

Scholz: Okay. Commissioner Crane, you had a question.

Crane: Yes, this may be for Mr. Ochoa, but you've shown us several signs that in the case of the Big 5 and Ross violate the LAO, but Mr. Ochoa told us that was grandfathered in. What about the other signs that seem to be pole signs, were they grandfathered in? The Walgreens one wasn't I'm pretty sure.

Ochoa: No, sir, that is correct Commissioner Crane. Those signs are on the opposite side of Nacho which do not require to be monument signs. Only signs I believe it's east of Nacho Street have to be monument signs.

Crane: Okay, thank you.

Scholz: Okay, I just had one question for you.

Swartz: May I argue? It's not that they have to be monument signs, the ones west of Nacho still have to conform to monument, but they don't have to be seven foot tall and 40-foot in square footage. Up until Walnut, they have to be of monument style. So Walgreens was given permission to just put up a pole sign.

Crane: Thank you.

Scholz: Okay. My question was actually and I think you answered it already, you have permission of the owner to do this?

Swartz: Mr. Anderson is right here in the audience.

Scholz: Okay, I'd like to talk to Mr. Anderson for just a moment, could I?

Anderson: Evening Commissioners, I'm Gary Anderson and I own and operate the development at 115 Roadrunner. And actually we do have five tenants in that facility where Carrie's at. Two right now are open for lease, and of course our business, we operate the Discount Pools and Spas. The one question I had too that I'm not aware of is with pole sign freestanding is per Mr. Ochoa, is that available signage for those two new tenants we're trying to attract into our center and you know I didn't know what the ordinance is read on that. But the (*inaudible*) devoted to the freestanding sign would affect the signage available on store fronts to the other say two tenants that we have vacant right now.

Scholz: Well Mr. Ochoa can answer that question right now. I see it on his face.

Ochoa: Excuse me Mr. Anderson, you're asking would the freestanding sign limit the attached signage for those tenants? No, sir, the Lohman Avenue Overlay businesses are allowed two separate signage which is the freestanding sign which is what we're talking about today, then attached signage which basically follows regular city sign code ordinances which is one and half square feet for every linear foot of I guess building length for that business.

Anderson: Thank you.

Scholz: Okay, so my question to you Mr. Anderson is, who's going to own the sign?

Anderson: Well at this point Carrie would own the sign and she's been willing to proceed with trying to sell it to the other tenants. I told her based on what kind of support that she had to own that avenue it'd be monetary and I've kind of told her that if it feels like it'd be a big asset for business to attract potential clientele I would like to see if the zoning commission would allow it or not.

Scholz: Well I find this an odd situation that an individual tenant wants to build a sign and owns the sign. Now if her business happens to move, does she simply take the sign with her?

Anderson: No, it normally becomes our property at this point.

Scholz: Okay, is that in your rental agreement or whatever, I mean …

Anderson: We haven't gotten to the really legal definition in contract form.

Scholz: Right, that's not my business. I'm just curious you know as to what's going on here.

Anderson: Right.

Scholz: Okay.

Anderson: She's kind of pursued it on her own and we were just more on a fact finding mission is what I've been on and just curious what the Commission might consider right or wrong on it.

Scholz: Okay, thank you very much. Anyone else from the public who wants to speak to this? Thank you very much for your presentation by the way. Appreciate it. Okay, I'm going to close it to public discussion. Gentlemen, what is your will? Commissioner Evans, I see something on your face there.

Evans: Well I am inclined to do something to help in the advertising you know of that piece of property. I think she has a good point. What I would like to see is some sort of process where the city is involved (*inaudible*) traffic, right-of-ways, all of those things which I'm not sure has gone into this plan to provide you know what the city would like to see … you know if we're going to say yeah let's put a sign there somewhere, either on the corner or where she has identified it, that's great you know. Let's do that, but let's make sure it's in the city's best interest. So I would like to see some sort of arbitration or you know something that the city can buy in and say okay we're going to put a sign there and if we have to do it this is how I think it should be done.

Ochoa: Commissioner Evans, Mr. Chairman, if I may add something to that. Tonight the variance … basically the variance that we're asking for is just the size and the height of the sign. With that she will still have to follow all clear sight triangle requirements, setback requirements, and if the proposed area where she wants to place the sign will not work from initial contact with her and with the conversation with her, it seems like the proposed area will work just fine, but if anything comes up, the sign would have to be moved on the property to somewhere better.

Evans: Okay.

Ochoa: So basically the variance is just for the actual sign itself. The placement would still have to follow city guidelines.

Evans: City guidelines. So that's number one. Number two is I'd like to see you know and we talked about this last time, a sign similar to what is in existence for Millers and all those other stores that reside in that complex. So I'd like to see more homogenous approach, like Commissioner Shipley said, so when somebody else moves in there, hey I need a big sign too. And it still goes back … I think that's the responsibility of the owner of that piece of property and I think that this Commission would be very amenable to really taking a look and approving something that addresses all of your tenants needs. Because I think there is a need there, and I guess I still haven't seen that yet and I would like to maybe even postpone this and give you a couple of months to go back and rethink this again because that's what we asked for last time. And what we got is a reshuffle of the same sign that was proposed last time. And I don't think that's what we're looking for.

Scholz: Okay. Commissioner Crane.

Crane: I think Ms. Swartz has provided what we asked for last time. Last time we didn't have any clarity about how other businesses might fit in on this, whether they go in with it or not. She has decided that she's prepared to put up the sign with enough space for other businesses if they want to come in and if they don't the sign ... what our job to do is to approve the size sign that she has suggested. My feeling is she has a very real hardship from what I've seen there and it seems to me unless I misread it that two out of the three criteria for identifying hardship are actually met, maybe a stretch, but you certainly have a topographic constraints which was not anticipated when the Lohman Avenue Overlay was devised. And you also, you could say this spurs economic development since obviously if you have five flourishing businesses in your unit you'd be happy. I don't think we're creating a precedent that would be abused because we are addressing the fact that this development, these two buildings are basically in a pit, and this I imagine doesn't occur very often. If somebody else came to us and said we can't be seen from the road, can we please have a sign that is ... a variance on the sign, I think we might be prepared for the same reasons to okay that. My inclination is to vote to approve the variance.

Scholz: Okay, any other comments. Commissioner Shipley.

Shipley: I think the location of this sign is important and I think there should be a sign there. The center should have a sign and it should be for all six of the people that reside in that complex, that includes the building A and building B. I think when you put the sign up on top of the hill at the 82 foot level that sign doesn't have to be 20 feet additionally in the air. That's why the Lohman Overlay District was created, was to control that side. And I think that there can be a seven foot sign with a 40 square foot there like that calls for out by the road that everybody can see going either direction. You know they're still going to have to ... there's no easy way to turn right at that point and go right into that shopping center. They've got to turn left on Foothills to enter the parking lot or right off of Roadrunner to enter the parking lot, either way. So, I'm not inclined to put a big 20 foot tall sign up in the middle of the air at 82 feet and then have something that's you know 40 feet below it. I think that's way too large and way out of scale for the size of this complex.

Scholz: Okay. Commissioner Bustos, any comments? Okay, I'll entertain a motion to approve the variance.

Crane: So moved.

Scholz: It's been moved. Is there a second?

Shipley: Second.

Scholz: It's been moved and seconded. I'll call the roll. Commissioner Shipley.

Shipley: Nay findings, discussion, and site visit.

Scholz: Commissioner Crane.

Crane: Aye findings, discussion, and site visit.

Scholz: Commissioner Evans.

Evans: No findings and discussion.

Scholz: Commissioner Bustos.

Bustos: No findings and discussion.

Scholz: And the Chair votes aye findings, discussion, and site visit. So the variance approval fails 3:2.

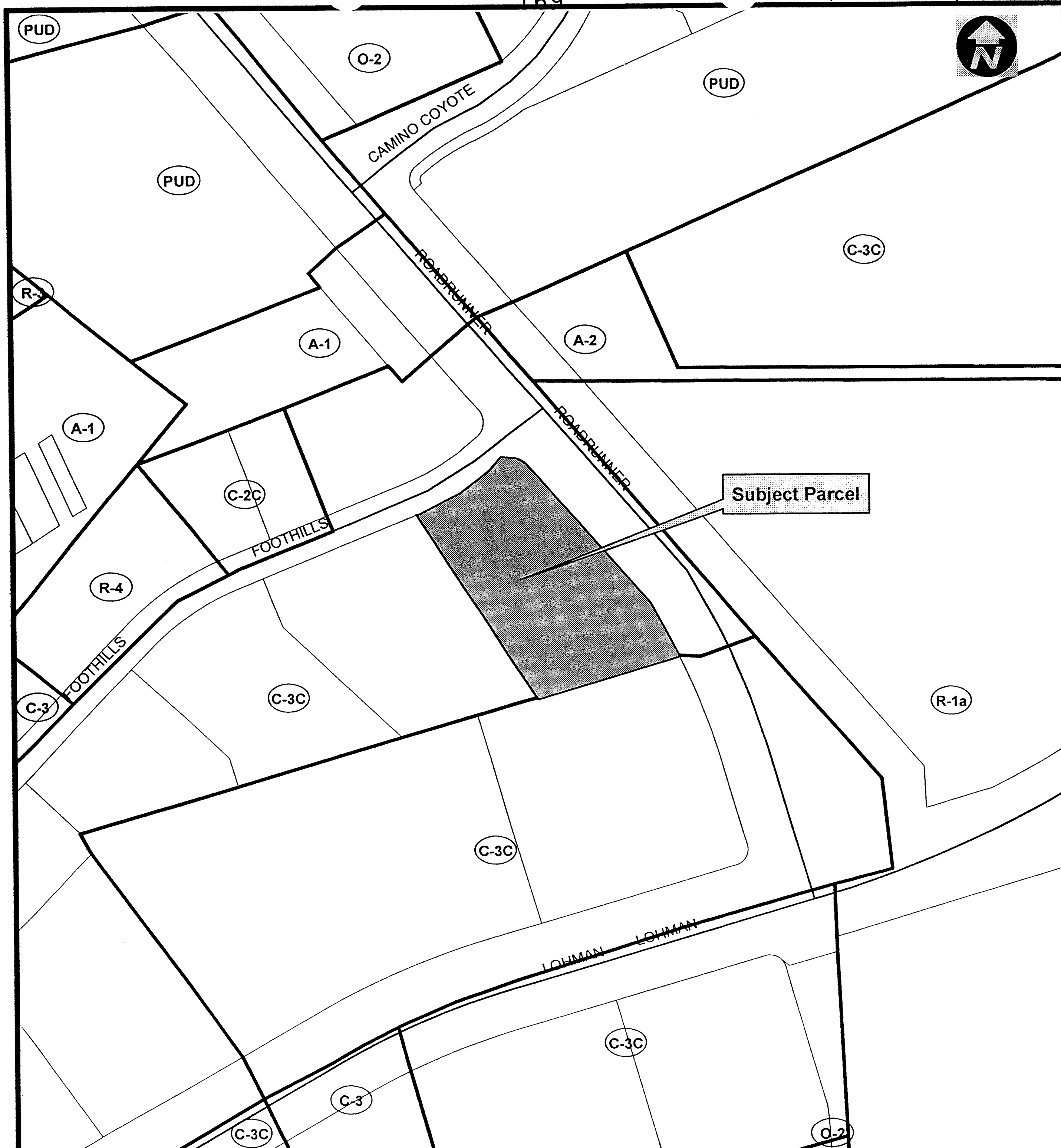
2. **Case A1702:** A request for a variance from the total number of freestanding signs allowed on a lot for a property located at 2540 S. Telshor. The subject property encompasses 0.70 +/- acres and is zoned C-3 (Commercial High Intensity). The number of freestanding signs is limited to one per lot in the City of Las Cruces, except where the street frontage of a lot exceeds 600 linear feet. The applicant would like to install a second freestanding sign on the subject property for a total of two freestanding signs on the lot. The subject property only measures a total of 385 +/- feet of street frontage. Submitted by Taj Construction Inc. for Ravi Gorav, M.D., property owner.

Scholz: Mr. Ochoa, you're up again. And I think we have another sign to look at.

Ochoa: That is correct. Second case for tonight is Case A1702. It's a request for a variance from the total number of freestanding signs allowed on a lot for a property located at 2540 S. Telshor. It was submitted by Taj Construction Inc on behalf of property owner Ravi Gorav, M.D.

Code requirements, basically under the sign code under Section 36-46b6 the number of free standing signs is limited to one per lot, except where the frontage of the lot exceeds 600 linear feet. For those lots, two

Attachment "D"



VICINITY MAP

CASE NO. A1701
PARCEL: 02-34032
OWNER: GARY K & ROBIN L ANDERSON
ADDRESS: 115 ROADRUNNER PKWY
ZONING: C-3C

0 75 150 300 450 600 Feet

This map was created by Community Development to assist in the administration of local zoning regulations. Neither the City of Las Cruces or the Community Development Department assumes any legal responsibilities for the information contained in this map. Users noting errors or omissions are encouraged to contact the Community Development Department at (505) 528-3043.

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