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Santa Monica Place
Santa Monica, California

LIGHTING STUDY

Prepared for: Macerich

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1. INTRODUCTION

The Santa Monica Place Signs Lighting Study (Study) is prepared by Francis Krahe & Associates Inc. to analyze the potential lighting impacts to adjacent sensitive use properties from illuminated signs that would be added to the exterior of the existing Santa Monica Place shopping center (Project Site). Macerich (Applicant), proposes to erect digital displays at the following locations:

- A. At the corner of 4th Street and Colorado Avenue, one 900 square foot east facing sign at 30 feet wide and 30 feet high.
- C. At the corner of Broadway and 4th Street, a 1040 square foot sign with two sign faces; one north facing (face C1) at 25 feet wide by 20 feet high (500 square feet); and one west facing (face C2) at 27 feet wide by 20 feet high (540 square feet).
- D. At the corner of Broadway and 2nd Street, one 754 square foot west facing sign at 29 feet wide and 26 feet high.

The Project's proposed sign plan would authorize the replacement of certain existing signs and the addition of new signs on existing development within the Project Site as identified in detail in the Conceptual Sign Plan for Santa Monica Place (the Conceptual Sign Plan, attached herein as Appendix A).

This Study reviews the parameters that affect light trespass and glare (each as defined below), reviews the applicable lighting metrics and regulations pertaining to artificial lighting, examines the existing lighting conditions within and surrounding the Project Site, and evaluates the illuminated signs within the Conceptual Sign Plan to identify the Project's potential lighting environmental impacts.

The methods of analysis utilized for this Study are based upon the recommended practices established by the Illuminating Engineering Society of North America (IESNA) for the practice of illumination engineering design and application, and the actual measurements of light sources and illuminated surfaces. IESNA reference publications include: American National Standards Institute (ANSI)/Illuminating Engineering Society (IES) OL-IM-01 Lighting Fundamentals, Metrics and Calculations; ANSI/IES OL-IM-02 Lighting Design, Engineering, and Specifications; ANSI/IES OL-IM-03 Lighting Design Criteria and Illumination Recommendations; and ANSI/IES OL-IM-04 Lighting Equipment Testing Procedures and Measurements, ANSI/IES OL-IM-05, Lighting Roadway and Parking Facilities. The ANSI/IES Standards supersede and replace the IESNA 10th Edition Handbook, and various previous references published by IESNA.

2. SUMMARY OF LIGHT TRESPASS AND GLARE

This Study evaluates potential environmental impacts from the Project's new illuminated signs that would be authorized by the proposed Project, and are identified within the Conceptual Sign Plan included as Appendix A (Project Signs). Project Signs evaluated in this Study include the Digital Display Signs described below in Section 3 and illustrated in Appendix A. The Lighting Study analyzes light from the Project that may affect the environmental conditions at surrounding properties. For this Study the light from the Project is analyzed at sensitive use properties where additional light from the Project may substantially impact the use of these properties. Sensitive use properties include residential properties, hotel properties, hospitals, and outdoor dining facilities. Commercial use properties such as office buildings or retail stores are not considered sensitive use properties. Environmental impacts from the Project Signs at sensitive use properties are evaluated with respect to light trespass and glare. These two technical terms are defined by the IESNA as follows:

- **Light Trespass¹** is unwanted stray light on surrounding properties. Light trespass is measured in terms of illuminance (foot-candles or metric units lux), and can be measured at any point and in any direction. Where Light trespass is evaluated for this Study, the illuminance is measured perpendicular to the source of light, toward the source of light, at the sensitive use property line, or the location where light would cause an issue. Light trespass is evaluated at night.
- **Glare²** occurs when the eye is unable to comfortably adapt to the visual scene. This condition may occur when the overall light level is too great, or where there is a large difference of brightness in a visual field. A bright light source, such as a flood light or streetlight, viewed against a dark sky may be uncomfortable to look at, and may create a temporary sensation of blindness, which is referred to as disability glare. Glare is evaluated by measuring the luminance (footlamberts or metric units candelas/m²) at the source of light, such as a digital sign, in comparison to the surrounding adjacent luminance within the field of view. In this Study, the contrast ratios define the extent of glare within the field of view at any observer position. The contrast ratio is determined by the variation of luminance within the field of view. “High,” “Medium,” and “Low” contrast ratios are the comparison of peak measured luminance to the average luminance within a field of view: Contrast ratios greater than 30:1 (High); between 30:1 to 10:1 (Medium); and below 10:1 (Low), respectively. Contrast ratios above 30:1 are generally uncomfortable for the human eye to perceive. Any source luminance that is more than 50 times the adjacent background luminance will be viewed as prominent and may be viewed as distracting. Glare may occur either during the day or night.

2.1 Light Trespass

Regarding light trespass, this Study analyzes the proposed Project’s compliance with the City of Santa Monica Municipal Code (SMMC), the California Energy Code and the California Building Code. The SMMC does not include specific regulations with regard to the amount of light trespass from illuminated signs at sensitive use properties. Therefore this Study utilizes the light trespass and glare regulations identified in the California Energy Code (CEC) to provide a conservative analysis of the potential for the Project to create a new source of light trespass at sensitive use properties.

2.2 Glare

This Study demonstrates that the Project Signs will not create glare, i.e., will not create a new high contrast condition visible at adjacent residential properties or at adjacent roadways. This Study analyzed the contrast ratio, which compares the maximum Project Sign luminance to the existing average luminance measured at monitoring sites adjacent to the Project Site, and determined that contrast ratio will be less than 30:1 at each of these monitoring sites. Contrast ratios less than 30:1 indicate there is no glare from the Project Signs. Therefore, the Project will not create a new glare condition at adjacent sensitive use or residential properties.

The glare visible to drivers at roadways is evaluated with respect to the standards identified by the California Vehicle Code, which defines maximum permissible luminance within drivers’ field of view during the day and during periods of low sun intensity such as overcast sky conditions, twilight, or at night. This Study confirms that the Project Signs would not exceed the maximum luminance defined by the California Vehicle Code during the day, or during periods of low sun intensity such as overcast sky conditions, or twilight, or at night.

The Project has been designed to include the following Project Sign features, which are included as requirements in the proposed Project:

- Project Signs will not create light trespass at sensitive use properties greater than 0.74 footcandles (fc).
- Project Signs will not exceed the nighttime luminance of 400 candelas per square meter (cd/m²) at night from sunset until sunrise.

¹ ANSI_IES LP-2-20, Lighting Practice: Designing Quality Lighting for People in Outdoor Environment, Section 2.3.2 Light Trespass, page 4

² ANSI_IES LS-8-20, Lighting Science: Vision – Perceptions and Performance, Section 4.4 Glare, page 16

- Project Signs will not exceed the daytime luminance of 6000 candelas per square meter (cd/m²) during the day, from 45 minutes after sunrise until 45 minutes prior to sunset.
- Project Signs luminance shall transition smoothly from daytime luminance to nighttime luminance and vice versa over a period of no less than 45 minutes.
- Project Signs will include an electronic control system to reduce maximum Project Sign luminance to the maximum nighttime brightness (400 cd/m²) at any time when ambient sunlight is less than 100 footcandles (fc).
- Project Signs maximum power will not exceed 12 watts per square foot.

3. PROJECT DESCRIPTION

The Project includes three proposed Signs labeled Sign A; Sign C, with two sign faces C1 and C2; and Sign D, which are shaded blue and located as illustrated in Figure 1, and further defined in the Conceptual Sign Plan in Appendix A.

These three Project Signs will be installed within the existing commercial use property (Property) located at 395 Santa



Figure 1: Project Site and Adjacent Sensitive Use Properties

Monica Place, in Santa Monica, California, which is shaded green in Figure 1. The Property is surrounded by Colorado Boulevard to the east, Fourth Street to the north, Broadway to the west and Second Street to the south. There are existing

sensitive use properties to the east, north, and west of the Property. The nearby sensitive use properties are shaded red in Figure 1.

The Project Signs will operate at a maximum luminance of 6000 cd/m² during the day and 400 cd/m² at night with a smooth transition from day maximum luminance to night maximum luminance beginning 45 minutes prior to sunset and concluding at sunset, and from night maximum luminance to day maximum luminance from sunrise and concluding 45 minutes after sunrise. Illuminated signs will include an electronic control system to reduce sign luminance to the maximum nighttime brightness (400 cd/m²) at any time when ambient sunlight is less than 100 footcandles (fc).

4. GLOSSARY OF LIGHTING TERMINOLOGY³

Discussions of lighting issues include precise definitions, descriptions or terminology of the specific lighting technical parameters. The following glossary summarizes explanations of the technical lighting terms utilized in this Study and the related practice standards. The following technical terms are used in this Study.

Brightness:	The magnitude of sensation that results from viewing surfaces from which light comes to the eye. This sensation is determined partly by the measurable luminance of the source and partly by the conditions of observation (Context), such as the state of adaptation of the eye. For example, very bright lamps at night appear dim during the day, because the eye adapts to the higher brightness of daylight.
BUG Rating:	A luminaire classification system established in <i>IES TM15-11</i> , BUG Ratings Addendum that provides for uniform assessment of the directional characteristics of illumination for exterior area lighting. BUG is an acronym composed of Backlight, Uplight, and Glare. BUG ratings are based on a zonal lumen calculations for secondary solid angles defined in <i>IES TM15-11</i> .
Candela:	Measure of light energy from a source at a specific standard angle and distance. Candela (cd) is a convenient measure to evaluate output of light from a lamp or light fixture in terms of both the intensity of light and the direction of travel of the light energy away from the source.
Contrast:	Calculated evaluation of high, medium and low contrast of visible light sources or surfaces within the Property by a ratio of luminance. Contrast is the ratio of one surface luminance to a second surface luminance or to the field of view. Contrast exceeding 30 to 1 are usually deemed uncomfortable; 10 to 1 are clearly visible; and less than 3 to 1 appear to be equal.
Electronic Control System:	Integrated hardware and software system which provides sign lighting control functionality for time of day scheduling, response to ambient light, and direct user control with full range of dimming from 0% to 100% full light output, full color, or all white.
Fully Shielded:	A lighting fixture constructed in such a manner that all light emitted by the fixture, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the Luminaire, is projected below the horizontal as determined by photometric test or certified by the manufacturer. Any structural part of the light fixture providing this shielding must be permanently affixed. In other words, no light shines above the horizontal from any part of the fixture.

³ ANSI/IES LS-1-22 Lighting Science: Nomenclature and Definitions for Illuminating Engineering

Glare:

Glare is visual discomfort experienced from high luminance or high range of luminance. For exterior environments at night, glare occurs when the range of luminance in a visual field is too large. The light energy incident at a point is measured by a scale of footcandles or lux, and is described in the technical term Illuminance. This incident light is not visible to the eye until it is reflected from a surface, such as pavement, wall, dust in the atmosphere or the surface of a light bulb. The visible brightness of a surface is measured in footlamberts (or metric equivalent candelas per square meter) and is described by the term Luminance.

The human eye processes brightness variations across a very broad spectrum of intensities. The range of brightness generated by direct noon sun versus a moonlight evening is over 5000 to 1. Human eyes are capable of accommodating to this range of intensities given adequate time to adjust. However, the eye cannot process brightness ratios of more than 30 to 1 within a view without discomfort.

For the purpose of this analysis, brightness of light sources may be described subjectively by the following criteria:

High Contrast Conditions: View of light fixture emitting surface, such as a lens, reflector, or lamp, where brightness contrast ratio exceeds 30 to 1 (source Luminance to background Luminance ratio in footlamberts).

Medium Contrast Conditions: Brightly lighted surfaces where contrast ratio exceeds 10 to 1, but is less than 30 to 1 (lighted surface Luminance to background Luminance ratio in footlamberts).

Low Contrast Conditions: Illuminated surfaces where contrast ratio exceeds 3 to 1, but less than 10 to 1 (source Luminance to background Luminance ratio in footlamberts).

Illuminance:

Illuminance is the means of evaluating the density of Luminous Flux. Illuminance indicates the amount of Luminous Flux from a light source falling on a given area. Illuminance is measured in footcandles (fc) which is the lumens per square foot, or Lux (lumens per square meter). Illuminance need not necessarily be related to a real surface since it may be measured at any point within a space. Illuminance is determined from the Luminous intensity of the light source. Illuminance of a point source decreases with the square of the distance from the light source (see Inverse Square Law definition).

For the purposes of this analysis, illuminance may be described subjectively by the following criteria:

High Illuminance: Illuminance greater than the maximum permitted by the CEC, and greater than 0.74 footcandles.

Medium Illuminance: Illuminance less than 0.74 footcandles and greater than 0.30 footcandle.

Low Illuminance: Illuminance less than 0.30 footcandles

Horizontal Illuminance:

Illuminance incident upon a horizontal plane. The orientation of the illuminance meter or calculation point will be 180° from Nadir.

Vertical Illuminance:

Illuminance incident upon a vertical plane. The orientation of the illuminance meter or calculation point will be 90° from Nadir.

Inverse Square Law:

In physics, an inverse-square law is any physical law stating that a specified physical quantity or intensity is inversely proportional to the square of the distance from the source of that physical quantity. The fundamental cause for this relationship can be understood as geometric dilution corresponding to point-source radiation into three-dimensional space (see Figure 2). The divergence of a vector field which is the resultant of radial inverse-square law fields with respect to one or more sources is everywhere proportional to the strength of the local sources, and hence zero outside sources. Newton's law of universal gravitation follows an inverse-square law, as do the effects of electric, magnetic, light, sound, and radiation phenomena. Thus, Illuminance decreases with the square of the distance from the light source.

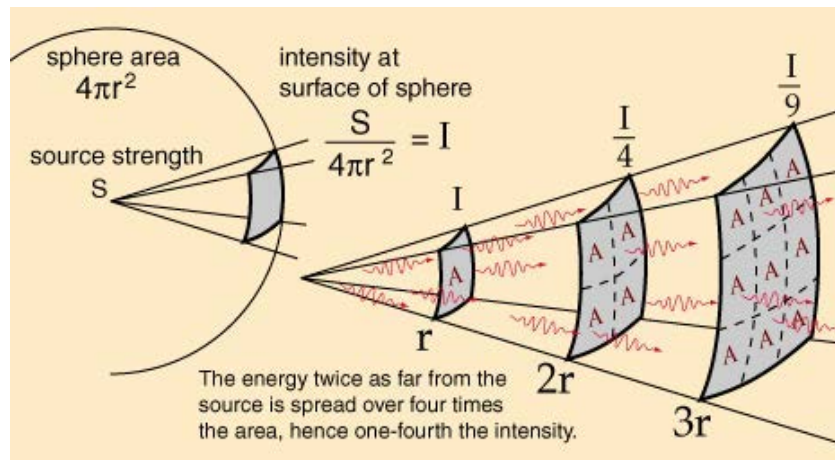


Figure 2: Inverse square law diagram (hyperphysics.phy-astr.gsu.edu)

Output Direction:

Luminaires for general lighting are classified in accordance with the percentages of total luminaire output emitted above and below horizontal. The light distribution curves may take many forms within the limits of upward and downward distribution, depending upon the type of light and the design of the luminaire.

Lighting Array:

An installation of multiple light sources or lamps where the distance between each lamp or light source within the Lighting Array is less than 5 feet on center in any direction from any other source.

Light Source:

Device which emits light energy from an electric power source.

Light Trespass:

Electric light from subject property incident onto adjacent properties, measured in footcandles or lux, usually analyzed by measurement at or near the adjacent property line.

Lighting Zone (LZ):

Defined by IESNA⁴ and summarized on pages 10 and 11 in the LP-11-20 Environmental Considerations for Outdoor Lighting and adopted by CALGreen.

⁴ ANSI LP-11-20 Environmental Considerations for Outdoor Lighting, page 10

Lighting Zone LZ3: Outdoor areas of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience.

Luminaire: A complete lighting unit consisting of a light source together with the parts designed to distribute the light, to position and protect the light source, and to connect the light source to the power supply. Also referred to as a Light Fixture.

Luminance: Luminance is a measure of emissive or reflected light from a specific surface in a specific direction over a standard area. Luminance is measured in footlamberts (fL) ($1/\pi$ Candela per square foot) or cd/m^2 (Candela per square meter). $1\text{fL} = 3.43 \text{ cd}/\text{m}^2$.

Whereas Illuminance indicates the amount of Luminous Flux falling on a given surface, Luminance describes the brightness of an illuminated or luminous surface. Luminance is defined as the ratio of luminous intensity of a surface (Candela) to the projected area of this surface (m^2 or ft^2).

Luminous Flux: Mean value of total Candelas produced by a light source. Luminous Flux describes the total amount of light emitted by a light source. The unit for measuring Luminous Flux is Lumen (lm).

This radiation could basically be measured or expressed in watts. This does not, however, describe the optical effect of a light source adequately, since the varying spectral sensitivity of the eye is not taken into account. To include the spectral sensitivity of the eye the Luminous Flux is measured in lumen. Radiant Flux or 1 W emitted at the peak of the spectral sensitivity (in the photopic range at 555 nanometers produces a Luminous Flux of 683 lumen). The unit of lumen does not define direction.

Monitoring Sites: Monitoring Sites are locations selected for observation and field lighting measurements to evaluate the views to the Project Site from adjacent sensitive use properties and to determine the extent and intensity of existing light sources within and surrounding the Project Site. The Monitoring Sites are within the public right of way and may be adjacent to sensitive use sites. These locations are representative of the view to the Project from the vicinity of the sensitive sites surrounding the Project Site to the north, south, east and west. Figure 5 below illustrates the Monitoring Site locations.

5. REVIEW OF LIGHTING REGULATIONS AND REFERENCE STANDARDS

Exterior lighting is regulated throughout California by local municipal codes and the California energy and building codes. Pertinent lighting sections are summarized and discussed for the City of Santa Monica Municipal Code (SMMC), the California Vehicle Code, the California Green Building Standards Code (CalGreen), and the California Energy Code (CEC). Reference standards include model lighting ordinances provided by the Illuminating Engineering Society of North America (IESNA) and the International Dark Sky Organization. Various aspects of these reference standards are included in local regulations to improve the outcomes of any approved project and avoid future disputes or legal challenges to proposed lighted signs. The lighting standards summarized below balance the requirements of property owners for sufficient brightness and flexibility for the use of the signs, with minimizing the off-site negative effects of light trespass and glare.

5.1 Santa Monica Municipal Code

The SMMC regulates signs within Chapter 9 PLANNING AND ZONING. The SMMC exempts Sign Lighting from the requirements in Section 9.21.080 Lighting, and is silent with respect to light trespass from signs (i.e., the spillover of light

onto adjacent light-sensitive properties). The City also enforces the applicable requirements of the California Building Code, CALGreen, and the CEC. SMMC Section 9.21.080 includes the following sections regarding lighting:

a. 9.21.080 Lighting

A. Applicability. The standards of this Section shall apply to the following:

1. New Lighting. All new exterior lighting, including lighting fixtures attached to buildings, structures, poles, or self-supporting structures. Exterior lighting may be found on parking lots, walkways, building entrances, outdoor sales areas, landscaping, recreational fields, and building faces....

B. Exemptions. The following specific types of lighting are exempt from the requirements of this Section:....

4. Sign lighting (See Chapter 9.61, Signs).

b. 9.61.030.220 Illuminated Sign.

Any sign for which an artificial source of light is used in order to make readable the sign's message, including internally and externally lighted signs and reflectorized, glowing, or radiating signs.

The SMMC does not include specific regulations with regard to the amount of light trespass from illuminated signs at sensitive use or residentially zoned properties. Therefore this Study utilizes the light trespass and glare regulations identified in the California Energy Code (CEC) to provide a conservative analysis of the potential for the project to create a new source of light trespass at sensitive use properties.

5.2 California Code of Regulations, Title 24 (California Building Standards Code)

Title 24 of the California Code of Regulations (CCR), also known as the California Building Standards Code, includes regulations for signs throughout the State of California. The following components of Title 24 include standards related to Sign Lighting:

a. 2022 California Administrative Code, Administrative Regulations for the California Energy Commission (CEC):

The California Administrative Code, which is Part 1 of Title 24, includes Section 10-114., Determination of Outdoor Lighting Zones and Administrative Rules for Use. This section establishes rules for implementing outdoor lighting zones, and is included herein as Appendix B.

Nighttime lighting environment are defined as Lighting Zones 0 through 4 in Table 10-114-A LIGHTING ZONE CHARACTERISTICS AND RULES FOR AMENDMENTS BY LOCAL JURISDICTIONS. The requirements of Section 10-114 are established to show compliance with Section 140.7 of Title 24, California Code of Regulations, Part 6. The description of nighttime lighting environments in Table 10-114 are similar to IESNA RP-8-22 Table 4-1, discussed below.

The Project Site and surrounding properties are an urban, mixed use, commercial and residential zone with extensive nighttime use, including nearby retail, restaurants, and entertainment venues. Current best practices for lighting standards recognize the unique issues related to nighttime use adjacent to sensitive use sites. As noted above, CEC includes designations for Lighting Zones (LZ) 0 through 4, included below in Appendix B, which correspond to the light trespass illuminance recommendations within the IESNA RP-8-22 Table 4-2, included herein Appendix G. The IESNA recommendations for light trespass illuminance vary based upon the extent of nighttime human activity and the extent of natural habitat.

The Project Signs have been designed to include energy use and lighting control systems that comply with CEC Sections 130.3 and 140.8 and that are included as project design features required in the proposed Conceptual Sign Plan. Specifically, the Project Signs comply with the following requirements:

- All outdoor Project Signs shall be controlled with a photocontrol in addition to an automatic time-switch control, or an astronomical time-switch control.
- All outdoor signs that are illuminated at night and for more than 1 hour during daylight hours shall be controlled with a dimmer that provides the ability to automatically reduce Project Signs power by a minimum of 65 percent during nighttime hours.
- For internally illuminated Project Signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot.

Each of the above requirements is satisfied by the electronic control system which is included as a proposed Project design feature in the Conceptual Sign Plan. Therefore, the Project will satisfy the exceptions to CEC Section 140.7(a). Accordingly, the Project Signs are not subject to the light trespass and glare requirement of CALGreen Section 5.106.8. However, to present a conservative analysis of the potential lighting impacts to adjacent sensitive use and residential use properties, this Study analyzes the Project Signs light trespass with respect to the CALGreen and CEC requirements for outdoor lighting.

b. California Energy Code 2022, Section 140.7, PRESCRIPTIVE REQUIREMENTS FOR OUTDOOR LIGHTING

The California Energy Code (CEC) stipulates allowable energy use for Outdoor Lighting (see Appendix C herein), including with the aim of reducing energy consumption at night through efficient and effective use of sign lighting equipment. Sign lighting is exempt as per "Section 140.7 (a), Exceptions to Section 140.7(a) ... 7. Lighting of signs complying with the requirements of Sections 130.3 and 140.8". However, the requirements of CEC are applied in this Study to present a conservative analysis of Light Trespass Illuminance at residential use properties.

c. California Energy Code 2022, Section 130.3, SIGN LIGHTING CONTROLS

The California Energy Code (CEC) stipulates control requirements for signs (see Appendix D herein), including with the aim of reducing energy consumption at night through efficient and effective use of sign lighting equipment.

d. California Energy Code 2022, Section 140.8, PRESCRIPTIVE REQUIREMENTS FOR SIGNS

The California Energy Code (CEC) stipulates energy and light source requirements for signs (see Appendix E herein), including requirements for "(a) Maximum allowed lighting power.", or "(b) Alternate lighting sources." Both sections require high efficiency light sources, LED, or equivalent.

5.3 California Vehicle Code, Division 11. Rules of the Road

Chapter 2, Article 3 of the California Vehicle Code (CVC) Division 11 Rules of the Road stipulates limits to the location of light sources that may cause glare and impair the vision of drivers. CVC Section 21466.5. provides in relevant part:

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

The brightness reading of an objectionable light source shall be measured with a 11/2-degree photoelectric brightness meter placed at the driver's point of view. The maximum measured brightness of the light source within 10 degrees from the driver's normal line of sight shall not be more than 1,000 times the minimum measured brightness in the driver's field of view, except that when the minimum measured brightness in the field of view is 10 foot-lamberts or less, the measured brightness of the light source in foot-lambert shall not exceed 500 plus 100 times the angle, in degrees, between the driver's line of sight and the light source.

This Study analyzes the standard set forth in CVC Section 21466.5 as it applies to the Project Signs on drivers within adjacent streets.

5.4 IESNA Recommended Practices

The Illuminating Engineering Society of North America (IESNA) recommends illumination standards for a wide range of building and development types. These recommendations are widely recognized and accepted as best practices and are therefore a consistent predictor of the type and direction of illumination for any given building type. For all areas not governed by the regulatory building code, municipal code or specifically defined requirements, the IESNA standards are used as the basis for establishing the amount and direction of light recommended for the Project.

As stated above, ANSI/IESNA RP-8-22 Table 4-2, included herein as Appendix G, defines Outdoor Lighting Zones relative to a range of human activity versus natural habitat. Table 4-2 of Appendix G establishes the Zone designation for a range of existing lighting conditions, from low or no existing lighting to high light levels in urban areas. Table 4-2 is referenced by the CEC as noted above in relation to allowable energy use for outdoor lighting. In addition, ANSI/IESNA RP-8-22 defines Recommended Light trespass Limits in Table 4-2 included in Appendix G hereto, relative to the Outdoor Lighting Zones. The Recommended Light Trespass Illuminance Limits describe the maximum Light trespass values in Lux at the location where trespass is under review.

The existing conditions surrounding the Project Site are best described as Lighting Zone 3. IESNA RP-8-22 Table 4-2, lists a Pre-curfew 8 Lux (which is equivalent to 0.74 footcandles) maximum at the location where trespass is under review for Zone 3. As the City does not have a light trespass standard applicable to signs, this Study uses the IESNA maximum as the threshold of significance for light trespass. There is no established City of Santa Monica standard for Pre-curfew, however generally the curfew would conclude up to when the commercial retail places close for business.

6. SIGNIFICANCE THRESHOLD

Appendix G of the California Environmental Quality Act (CEQA) Guidelines (14 California Code of Regulations, Sections 15000–15387) provides a set of sample questions to evaluate impacts with regard to aesthetics, including light and glare. The City of Santa Monica uses the Appendix G “questions” as its significance thresholds. The question that pertains to light trespass and glare is as follows:

Would the project:

Create a new source of substantial light and glare which would adversely affect day or nighttime views in the area?

In the context of this question from the CEQA Guidelines, the determination of significance in this Study takes into account the following factors:

- The change in ambient nighttime levels as a result of Project lighting sources; and
- The extent to which light from the Project would spill off the Project Site and affect adjacent residential properties.

Specifically, the Project Signs would create a significant impact with regard to artificial light or glare if:

- Light Trespass illuminance from the Project Signs exceeds 0.74 fc at the property line of a sensitive use property;
- The Project Signs create glare with new high contrast conditions, with luminance greater than 400 cd/m² at night and contrast ratio greater than 30:1, visible from a field of view from a sensitive use property; or
- The Project Signs create glare effects on drivers of motor vehicles by exceeding the maximum luminance standards established by Section 21466.5 of the California Vehicle Code, where maximum brightness of the Project Sign within 10 degrees from the driver’s normal field of view is greater than 1,000 times the minimum measured brightness in the driver’s field of view, or when the minimum measured brightness in the field of view is 10 footlamberts or less,

the measured brightness of the light source in footlambert exceeds 500 plus 100 times the angle, in degrees, between the driver's field of view and the light source.⁵

7. METHODOLOGY

7.1 Existing Conditions Procedures

Existing conditions lighting observations were conducted following recommended practice procedures defined by the IESNA in RP-33-00 Lighting for Outdoor Environments, TM10-00 Addressing Obtrusive Light (Urban Sky Glow and Light trespass) in Conjunction with Roadway Lighting, and TM11-00 Light trespass: Research, Results and Recommendations. Field illuminance and luminance measurements were conducted to accurately document all existing incident and visible light at each Monitoring Site location. Incident light can be understood as a vector of luminous flux moving through space. As the vector (light) is incident upon a surface, the intensity of the resulting illuminance will vary depending upon the relative orientation of the vector to the surface. The greatest illuminance will result when the surface and vector are perpendicular. The least illuminance will result when the surface and vector are parallel. In the field conditions,



Figure 3: Minolta LS-100 meter

where there are multiple sources of light originating from varied positions, illuminance measurements are recorded horizontally with the photosensor facing up at 3 feet above grade, and vertically with the photosensor facing the Project as per IESNA standards. These measurements document the total horizontal illuminance received at a Monitoring Site as well as the direction and intensity of light converging on the Monitoring Site from the direction of the Project Site. Since most of the Monitoring Sites are located at distances from the Project Site greater than 50 feet, as noted in Section 7 below, the vertical illuminance represents a plane perpendicular to the light sources. Under these conditions, there is little difference between the vertical and perpendicular plane, and the vertical plane analysis that is conducted in this Study would be equal to or greater than the measured luminance from a precisely perpendicular plane analysis. Therefore, this Study utilizes a vertical illuminance analysis. The existing Illuminance is measured with a Minolta Illuminance meter.

The existing luminance is measured from a Monitoring Site to light sources and surfaces within the field of view toward the Project Site from that Monitoring Site. This existing conditions luminance data is measured with a Minolta LS-100 Luminance meter with procedures consistent with best practices for field measurement of luminance as per IESNA standards. The LS-100 Luminance meter utilized by Francis Krahe & Associates, Inc. reports luminance data in either candelas per square meter (cd/m^2) or footlamberts (fL). All existing luminance data measured and reported in this Study are recorded as cd/m^2 .

7.2 Analysis

This analysis of the Project Signs include evaluation of the light trespass at the nearest sensitive use properties from the Project Signs, and an evaluation of light from the Project Signs visible at sensitive use properties or at adjacent roadway locations to determine whether the Project Signs would introduce a new source of glare. This Study presents a conservative

⁵ The driver's field of view from the center of the roadway plus 10 degrees.

analysis with respect to light trespass and glare as described below. The Project Signs are evaluated with a sign configuration at the maximum permissible light intensity within the limits defined by the Conceptual Sign Plan as discussed in Section 1.2 above. This Study evaluates the proposed Project Signs as identified in the Conceptual Sign Plan in Appendix A.

a. Light Trespass Analysis

Light Trespass Illuminance is calculated at the location where lighting is under review through the illumination modeling software program AGI32. Light Trespass Illuminance is calculated by the illumination modeling software program AGI32 in accordance with the procedures defined by IESNA⁶. This software utilizes the 3-dimensional architectural computer model, including Project Sign locations, orientation, dimensions, and luminous specifications (as defined herein within Appendix A) to generate an accurate prediction of future illuminance from the Project Signs at adjacent sensitive use properties. Light Trespass illuminance is evaluated with respect to horizontal and vertical illuminance at the locations where lighting is under review.



Figure 4: Vertical Calculation Plane Locations

Light trespass is the artificial light produced from the Project Signs that falls on an adjacent property. Light trespass is measured in terms of illuminance (footcandles or metric units lux), and can be measured at any point and in any direction. Where light trespass is evaluated, the illuminance is measured perpendicular to the source of light, toward the source of light, at the property line, or the location where light would cause an issue, such as a residential window or balcony.

⁶ ANSI/IESNA Technical Memorandum: Calculation Procedures and Specification Criteria for Lighting Calculations

Light trespass illuminance is evaluated within vertical planes at each adjacent sensitive use property line extending from grade to the maximum occupied elevation above grade (for this Project varies from 90 feet to 210 feet above grade), which is above the maximum proposed Sign height as shown in the Appendix A. Figure 4 illustrates the locations of the vertical calculation planes for the analysis of the Project Signs light trespass illuminance as a dashed white line. This Study presents a conservative analysis of light trespass illuminance from Project Signs by utilizing the CEC defined maximum illuminance of 0.74 fc at the nearest sensitive use property. Therefore, the threshold for this analysis will be 0.74 fc maximum. The light trespass calculations simulate light meters at a vertical surface extending from grade to the height of the tallest occupied sensitive use property or the height of the Project Sign, whichever is greater. The vertical planes are located to capture light from all Project Signs that may be able to introduce new light toward the sensitive use properties. More distant properties will receive substantially less light due to the exponential reduction of light energy defined by the Inverse Square Law. The Project Signs analyzed are as defined in and as illustrated in the Conceptual Sign Plan (Appendix A). All Project Signs are analyzed operating simultaneously at maximum luminance of 400 cd/m², all white, at night. The Project Signs will not operate in an all-white mode in practice. However, this analysis with all Project Signs operating in all white mode presents a conservative (maximum) evaluation of the Project Signs' potential for offsite Light Trespass Illuminance. Table 5 below summarizes the Project Signs light trespass illuminance calculation data at the vertical plane locations illustrated in Figure 4.

b. Glare Analysis

Glare from the Project Signs⁷ is evaluated at night at nearby sensitive use properties and for drivers on adjacent streets. The glare from Project Signs is determined by the contrast ratio, which equals the maximum sign luminance divided by the measured average existing luminance within the visual field at the Monitoring Sites to the Project as identified in the field survey of existing conditions (see Section 8 below). Contrast ratios greater than 30:1 are considered "High" and potential glare conditions.

Light from the Project Signs that may impact drivers is analyzed with respect to compliance with the California Vehicle Code requirements for both night and day conditions at adjacent roadways. According to CVC Section 21466.5, the Project Signs would have a significant impact with regard to artificial light or glare if:

- The maximum measured brightness of a light source within 10 degrees from a driver's normal line of sight exceeds 1,000 times the minimum measured brightness in the driver's field of view when the minimum values in the field of view are 10 footlamberts (fL) or more.
- Or, when the minimum luminance in the driver's field of view is less than 10 footlamberts (fL) the source brightness exceeds 500 fL plus 100 times the angle, in degrees, between the driver's line of sight and the light source.

The analysis of glare that may impact drivers includes evaluation of all view angles from the driver's line of sight to the Project Signs, to determine the visibility of the Project Signs, and evaluates the maximum luminance permitted by the California Vehicle Code at any angle of view.

8. PROJECT EXISTING CONDITIONS

This Study includes field measurements of existing lighting conditions at locations surrounding the Project where light from the Project Signs may affect adjacent sensitive use properties. The following information summarizes the field measurements of existing lighting conditions, and the analysis of the existing conditions at the Project and at adjacent sensitive use properties that may have a view to the proposed Project Signs.

⁷ Luminance and or glare is not cumulative. Therefore, this Lighting Study evaluates the potential glare impact from the proposed Project Signs and not existing signs or other light sources.

8.1 Existing Conditions Monitoring Sites

Monitoring Sites are utilized to describe and evaluate the existing lighting conditions at and surrounding the Project Site to determine the maximum potential impacts that may result from light or glare onto adjacent sensitive use properties surrounding the Project. All Monitoring Site locations are within proximity of the Project and have views of the Project.



Figure 5: Project Site and Monitoring Site Locations

Monitoring Sites are located at existing residential use properties or are directly adjacent to existing residential properties.

The following criteria were used to select the Monitoring Site locations:

Project Light Visibility– Monitoring Sites were analyzed that provide direct view of the areas of greatest light intensity from the Project.

Proximity– Monitoring Sites at the least distance to the Project are analyzed. These locations are selected because light intensity decreases exponentially with distance. Locations at a greater distance will experience less light intensity than nearby locations.

Figure 5 shows the Project location, the Monitoring Site locations and the properties surrounding the Project. The Project site is shaded green and the Project Signs are shaded blue. Surrounding residential use properties are shaded red.

Monitoring Site locations were selected for observation and field lighting measurements to evaluate the views to the Project from adjacent sensitive use properties and to determine the extent and intensity of existing light sources within and surrounding the Project. The Monitoring Sites are within the public right of way, adjacent to residences or other sensitive

use properties. The Monitoring Site locations are representative of the view to the Project from the vicinity of the sensitive use properties surrounding the Project to the north, south, east, and west.

Monitoring Site M-N1: Monitoring Site M-N1 is located at 425 Broadway, north of the Project proposed Sign C, faces C1 and C2, to evaluate the Project north elevation. The distance to the Project property line is approximately 270 feet. The proposed Sign C, faces C1 and C2, will be visible to the south from M-N1. The existing lighting conditions at M-N1 are high horizontal and medium vertical illumination from City streetlights, City pedestrian lights, and City traffic lights. Prominent light sources visible in the field of view from M-N1 to the north side of the Project site include City streetlights, City pedestrian lights, commercial storefront lighting, and traffic lights.

Monitoring Site M-N2: Monitoring Site M-N2 is located at 400 Broadway, north of the Project proposed Project Sign C, face C1 at the northwest corner of the Project, to evaluate the Project north elevation. The distance to the Project property line is approximately 75 feet. The proposed Sign C, face C1, will be in full view to the south of M-N2. The existing lighting conditions at M-N2 are high horizontal and high vertical illumination from City streetlights, City pedestrian lights, and traffic lights. Prominent light sources visible in the field of view from M-N2 to the north side of the Project site include City streetlights, City pedestrian lights, parking garage lighting, and traffic lights.

Monitoring Site M-N3: Monitoring Site M-N3 is located in the alley behind 1548 5th Street, north of the Project property line, to evaluate the Project north elevation. The distance to the Project property line is approximately 248 feet. There is a very limited view to the south of M-N3 to the north side of the Project. No proposed Project Signs will be visible from M-N3. The existing lighting conditions at M-N3 are high horizontal and medium vertical illumination from adjacent building lighting which illuminates the alley. Prominent light sources visible in the field of view from M-N3 to the north side of the Project site include the adjacent building wall lights.

Monitoring Site M-N4: Monitoring Site M-N4 is located at 1539 4th Street, north of the Project property line, to evaluate the Project north elevation. The distance from M-N4 to the Project property line is approximately 75 feet. The north elevation of the Project is in full view to the south of M-N4. No proposed Project Signs will be visible from M-N4. The existing lighting conditions at M-N4 are high horizontal and low vertical illumination from City Street lighting and City pedestrian lighting. Prominent light sources visible in the field of view from M-N4 to the north elevation of the Project site include City streetlights, City pedestrian lights, and store front lighting within the Project.

Monitoring Site M-N5: Monitoring Site M-N5 is located at 1555 4th Street, north of the Project property line, to evaluate the Project north elevation. The distance to the Project property line is approximately 75 feet. The north elevation of the Project is in full view to the south of M-N5. No proposed Project Signs are visible from M-N5. The existing lighting conditions at M-N5 are high horizontal and high vertical illumination from City streetlights, City pedestrian lights, and traffic lights. Prominent light sources visible in the field of view from M-N5 to the north elevation of the Project site include City streetlights, catenary lights suspended above Colorado Boulevard, City pedestrian lights, and traffic lights.

Monitoring Site M-E1: Monitoring Site M-E1 is located at 302 Colorado Boulevard, to the east of the Project proposed Project Sign A, at the northeast corner of the adjacent commercial property line, to evaluate the Project east elevation. The distance from M-E1 to the Project property line is approximately 71 feet. Project Sign A will be in full view to the west of M-E1. The existing lighting conditions at M-E1 are high horizontal and high vertical illumination from adjacent catenary lights suspended above Colorado Boulevard, City streetlights, and traffic lights. Prominent light sources visible in the field of view from M-E1 to the east elevation of the Project site include catenary lights and traffic lights.

- Monitoring Site M-E2:** Monitoring Site M-E2 is located 203 ft to the east of the northeast corner of Colorado Ave and 4th Street, to the east of the Project Proposed Sign A, to evaluate the Project east elevation. The distance to the Project property line is approximately 260 feet. Sign A will be in partial view to the west of M-E2. The existing lighting conditions at M-E2 are medium horizontal and high vertical illumination from City streetlights, Metro Station lighting, and traffic lights. Prominent light sources visible in the field of view from M-E2 to the north elevation of the Project site include City streetlights, catenary lights suspended above Colorado Boulevard, Metro Station Lighting, and traffic lights.
- Monitoring Site M-E3:** Monitoring Site M-E3 is located at 250 ft diagonally to the Northeast of the northeast corner of Colorado Ave. and 4th Street, northeast of the Project Proposed Sign A, to evaluate the Project east elevation. The distance to the Project property line is approximately 322 feet. Sign A will be in partial view to the southwest of M-E3. The existing lighting conditions at M-E3 are high medium and high vertical illumination from City streetlights, Metro Station lighting. Prominent light sources visible in the field of view from M-E3 to the north elevation of the Project site include City streetlights Metro Station Lighting.
- Monitoring Site M-S1:** Monitoring Site M-S1 is located at 120 Broadway, to the south of Project proposed Project Sign D, to evaluate the Project south elevation. The distance to the Project property line is approximately 90 feet. The proposed Project Sign D will be in full view to the north of MS-1. The existing lighting conditions at M-S1 are high horizontal and high vertical illumination from City Street lighting. Prominent light sources visible in the field of view from M-S1 to the south elevation of the Project site include City streetlights, traffic lights, building sign lighting, and storefront windows.
- Monitoring Site M-W1:** Monitoring Site M-W1 is located at 1453 3rd Street, to evaluate the Project west elevation. The distance to the Project property line is approximately 94 feet. Proposed Project Sign C, face C2, will be visible to the north of M-W1. The existing lighting conditions at M-W1 are high horizontal and medium vertical illumination from 3rd Street Promenade lighting, and adjacent City street lighting. Prominent light sources visible in the field of view from M-W1 to the west side of the Project site include parking lighting, City street lighting, and City traffic lighting.
- Monitoring Site M-W2:** Monitoring Site M-W2 is located at 205 Broadway, west of the Project to evaluate the Project west elevation. The distance to the Project property line is approximately 84 feet. No proposed Project Sign will be visible from M-W2. The existing lighting conditions at M-W2 are high horizontal and medium vertical illumination from City street lighting. Prominent light sources visible in the field of view from M-W2 to the West side of the Project site include City street lighting, City traffic signal lights, and building and storefront lighting.
- Monitoring Site M-W3:** Monitoring Site M-W3 is located at 107 Broadway, west of the Project and south of the proposed Project Sign D, to evaluate the Project south and west elevations. The distance to the Project property line is approximately 330 feet. The proposed Project Sign D will be visible to the northeast of M-W3. The existing lighting conditions at M-W3 are medium horizontal and high vertical illumination from City streetlights and City pedestrian lights. Prominent light sources visible in the field of view from M-W3 to the south and west elevations of the Project site include City streetlights, City pedestrian lights, traffic signal lighting, and building and storefront lighting.

8.2 Criteria

As established in Section 7.3, the following factors were used to assess the existing conditions at each Monitoring Site:

Table 1. Existing Conditions Lighting Criteria

Criteria	Metric	Procedure
Light Trespass - Illuminance	Measured illuminance (footcandle) documented at each Monitoring Site	Measured illuminance recorded each Monitoring Site with Minolta illuminance meter.
Glare – Contrast Ratio	Measured luminance candelas per meter squared, documented at each Monitoring Site. Observed existing conditions.	Measured luminance recorded at each Monitoring Site with Minolta luminance meter. Day and night photograph to record the evaluation of the view to the Project Site from the Monitoring Site in terms of Project visibility and prominent light sources, lighted surfaces, and illuminated signs.

8.3 Sign Visibility Analysis

The visibility of the Project Signs at each Monitoring Site is evaluated during field surveys during the day and at night. Field survey data is presented in Table 2, which summarizes the distance from the Monitoring Site to the nearest adjacent Project Sign, and the visibility of the Sign location within the visual field observing from the Monitoring Site toward the Sign location.

Table 2. Distance & Sign Visibility at Monitoring Sites

Monitoring Site	Address	Distance to Project	Sign Visibility from Monitoring Site
M-N1	425 Broadway	270 feet to north Project property line.	Sign C, faces C1 & C2 will be visible
M-N2	400 Broadway	75 feet to north Project property line.	Sign C, face C1 & C2 will be visible
M-N3	Alley behind 1548 5 th Street	248 feet to north Project property line.	No Sign will be visible
M-N4	1539 4 th Street	75 feet to north Project property line.	No Sign will be visible
M-N5	1555 4 th Street	75 feet to north Project property line.	No Sign will be visible
M-E1	302 Colorado	71 feet to east Project property line.	Sign A will visible
M-E2	203 ft to the east of the northeast corner of Colorado Ave and 4 th Street	260 feet to east Project Property line.	Sign A will be in partial View
M-E3	250 ft diagonally to the Northeast of Colorado Ave. and 4th Street	322 feet to east Project Property line.	Sign A will be in partial View
M-S1	120 Broadway	90 feet to south Project property line.	Sign D will be visible

M-W1	1457 3 rd Street	94 feet to west Project property line.	Sign C, face C2 will be visible
M-W2	205 Broadway	84 feet to west Project property line.	No Sign will be visible
M-W3	107 Broadway	330 feet to south Project property line.	Sign D will be visible.

The distance from the Project site to adjacent sensitive use properties varies between 71 feet as the minimum distance at Monitoring Site M-E1 directly east of the Project, and the maximum distance at 330 feet to Monitoring Site M-W3 to the southwest of the Project.

The Project Signs are visible at Monitoring Sites M-N1, M-N2, M-E1, M-E2, M-E3, M-S1, M-W1, and M-W3. Further analysis is presented below to evaluate the Project Signs potential for light trespass and or glare at these sites, which are adjacent to the Project and have clear visibility of the Signs.

Monitoring Sites M-E1 and M-S1 are located adjacent to commercial use properties. Although these locations have visibility of the proposed Signs, commercial use properties are not considered a sensitive use, and therefore, there is no potential light trespass or glare impact at these Monitoring Sites. The Project Signs are not visible at Monitoring Site M-N3, M-N4, M-N5, and M-W2. Although this sensitive use location is adjacent to the Property there will be no light trespass or glare impact at this location since the Signs are not visible, and no detailed analysis of light trespass or glare from the Project is included for this Site.

8.4 Monitoring Site Night Survey Data

The existing lighting conditions within and surrounding the Project include City of Santa Monica streetlights within the adjacent public right of way, City of Santa Monica pedestrian lights within the public right of way, pole mounted lights within adjacent private surface parking lots, exterior surface mounted lighting utilized for security and safety, commercial illuminated signs, and store front window display lighting. The observations and measurement at each Monitoring Site of existing lighting conditions within and surrounding the Property are summarized below in relation to the evaluation factors established in Section 6, Significance Threshold.

Illuminance: The Illuminance listed in Table 3, below, summarize the measured Illuminance at each Monitoring Site. The measured illuminance is consistent with an urban lighting condition, with relatively high illuminance at the street and sidewalk within the public right of way and within nearby commercial properties, and lower illuminance within the residential properties, but sufficient light for safety and security.

Table 3. Measured Illuminance (fc) at Monitoring Sites

Monitoring Site	Illuminance (fc)		Location	Evaluation
	Horizontal	Vertical		
M-N1	5.05	0.45	425 Broadway	High horizontal illuminance Medium vertical illuminance
M-N2	1.19	1.65	400 Broadway	High horizontal illuminance High vertical illuminance
M-N3	19.18	0.58	Alley behind 1548 5 th Street	High horizontal illuminance Medium vertical illuminance
M-N4	3.53	0.05	1539 4 th Street	High horizontal illuminance Low vertical illuminance

M-N5	8.89	0.87	1555 4 th Street	High horizontal illuminance High vertical illuminance
M-E1	0.96	0.89	302 Colorado	High horizontal illuminance High vertical illuminance
M-E2	0.45	1.16	203 ft to the east of the northeast corner of Colorado and 4 th St.	Medium horizontal illuminance High vertical illuminance
M-E3	0.62	2.47	250 ft diagonally to the Northeast of the northeast corner of Colorado Ave. and 4th	Medium horizontal illuminance High vertical illuminance
M-S1	2.28	1.28	120 Broadway	High horizontal illuminance High vertical illuminance
M-W1	6.49	0.66	1453 3 rd Street	High horizontal illuminance Medium vertical illuminance
M-W2	1.49	0.33	205 Broadway	High horizontal illuminance Medium vertical illuminance
M-W3	0.46	1.11	107 Broadway	Medium horizontal illuminance High vertical illuminance

The Project Site currently includes lighting for the existing retail property, parking facilities and signs. Adjacent commercial properties to the south, east, and west contribute to a relatively bright night environment. Measured illuminance greater than 0.74 fc is evaluated as high illuminance, from 0.30 fc to 0.74 fc is evaluated as medium illuminance, and from 0.30 fc or less is evaluated as low illuminance.

The highest existing horizontal illuminance level was recorded at Monitoring Site at M-N3 with 19.18 fc, while the lowest horizontal illuminance was recorded at Monitoring Site M-E2 at 0.45 fc. The highest existing vertical illuminance level was recorded at Monitoring Site M-E3 at 2.47 fc, while the lowest vertical illuminance was recorded at Monitoring Site M-N1 at 0.45 fc.

Contrast/Glare: The visual evaluation of High, Medium and Low Contrast describes the perception of how bright a visible object appears to the surrounding objects within any given field of view and context. High Contrast indicates a potential glare condition for residential properties nearby.

Contrast is the ratio of one surface luminance to a second surface luminance or to the field of view. Contrast exceeding 30 to 1 are usually deemed uncomfortable and evaluated as high; less than 30 to 1 to greater than 10:1 is medium contrast; 10 to 1 are clearly visible and evaluated as low; and less than 3 to 1 appear to be equal and evaluated as very low.

Table 4. Measured Luminance, (cd/m²) at Monitoring Sites

Monitoring Site	Luminance (cd/m ²)		Contrast Ratio (Max / Average)	Location	Evaluation
	Average	Maximum			
M-N1	106.4	907.5	9 to 1	425 Broadway	Medium average luminance, Low contrast
M-N2	56.4	1005	18 to 1	400 Broadway	Medium average luminance, Medium contrast
M-N3	123.9	2042	17 to 1	Alley behind 1548 5th Street	Medium average luminance, Medium contrast
M-N4	369.6	8872	24 to 1	1539 4th Street	Medium average luminance, Medium contrast

M-N5	157.1	1656	11 to 1	1555 4th Street	Medium average luminance, Medium contrast
M-E1	60.6	1242	20 to 1	302 Colorado	Medium average luminance, Medium contrast
M-E2	203.1	3716	18 to 3	203' to the east of the northeast corner of Colorado and 4th St.	Medium average luminance, Medium contrast
M-E3	64	583	9 to 1	250ft diagonally to the Northeast of the northeast corner of Colorado Ave. and 4th	Medium average luminance, Low contrast
M-S1	497.6	4492	13 to 1	120 Broadway	High average luminance, Medium contrast
M-W1	216.2	3517	16 to 1	1453 3rd Street	Medium average luminance, Medium contrast
M-W2	134	2586	19 to 1	205 Broadway	Medium average luminance, Medium contrast
M-W3	342.1	7350	15 to 1	107 Broadway	Medium average luminance, Medium contrast

The measured luminance recorded at the Monitoring Sites within the view to the Project includes prominent, high brightness light sources and illuminated surfaces, such as streetlights, illuminated signs, and flood lighted buildings, as well as lower brightness surfaces such as sidewalks, parking lots, and un-illuminated walls or landscape areas. The existing Project Site is a retail shopping mall. The Project site is well illuminated with many bright surfaces visible. The range of recorded luminance is summarized in Table 4.

For this Study, the following luminance criteria are applied to measured and calculated luminance: luminance below 10 cd/m² is evaluated as low luminance; luminance greater than 10 cd/m² and less than 400 cd/m² is evaluated as medium luminance; luminance greater than 400 cd/m² is evaluated as high luminance.

The highest average luminance was recorded at Monitoring Site M-S1 at 497.6 cd/m², while the lowest average luminance was measured at Monitoring Site M-N2 at 56.4 cd/m², which is medium luminance. Therefore, the measured luminance range is from medium to high luminance. The measured average luminance is evaluated as Medium Luminance (greater than 10 cd/m² and less than 400 cd/m²) at eleven of twelve monitoring sites. The measure average luminance at Monitoring Site M-S1 is evaluated as High Luminance (greater than 400 cd/m²).

The highest maximum luminance was recorded at Monitoring Site M-N4 with 8872 cd/m², while the lowest maximum luminance was measured at Monitoring Site M-E3 at 583 cd/m². The measured maximum luminance is High Luminance (greater than 400 cd/m²) at all twelve monitoring sites.

The calculated contrast ratio (maximum luminance / average luminance) varies from a minimum of 9 to 1 at Monitoring Site M-N1 and ME3 to a maximum of 24 to 1 at Monitoring Site M-N4. The calculated existing contrast ratio at ten of the twelve Monitoring Site locations is evaluated as Medium Contrast (less than 30 to 1, and greater than 10 to 1). The calculated existing contrast ratio at Monitoring Site M-N1 is evaluated as low (less than 10 to 1).

8.5 Monitoring Site Data

a. Monitoring Site M-N1:

Monitoring Site M-N1: is located at 425 Broadway, north project property line, to evaluate the Project northwest elevations. The distance to the Project property line is approximately 270 feet.



Figure 6: M-N1 – 4/18/2023, 6:51 pm



Figure 7: M-N1 – 4/18/2023, 8:00 pm

b. Monitoring Site M-N2:

Monitoring Site M-N2 is located at 400 Broadway, north project property line, to evaluate the Project north elevations. The distance to the Project property line is approximately 75 feet.



Figure 8: M-N2 – 4/18/2023, 6:47 pm



Figure 9: M-N2 – 4/18/2023, 8:09 pm

c. Monitoring Site M-N3:

Monitoring Site M3-S is in the alley behind 1548 5th Street, north project property line, to evaluate the Project north elevations. The distance to the Project property line is approximately 248 feet.



Figure 10: M-N3 – 4/18/2023, 6:40 pm



Figure 11: M-N3 – 4/18/2023, 8:20 pm

d. Monitoring Site M-N4:

Monitoring Site M-N4 N4 is located at 1539 4th Street, north Project property line, to evaluate the Project north elevations. The distance to the Project property line is approximately 75 feet.



Figure 12: M-N4 – 4/18/2023, 6:44 pm



Figure 13: M-N4 – 4/18/2023, 8:30 pm

e. Monitoring Site M-N5:

Monitoring Site M-N5 is located at 1555 4th Street, North Project property line, to evaluate the Project North elevations. The distance to the Project property line is approximately 75 feet.

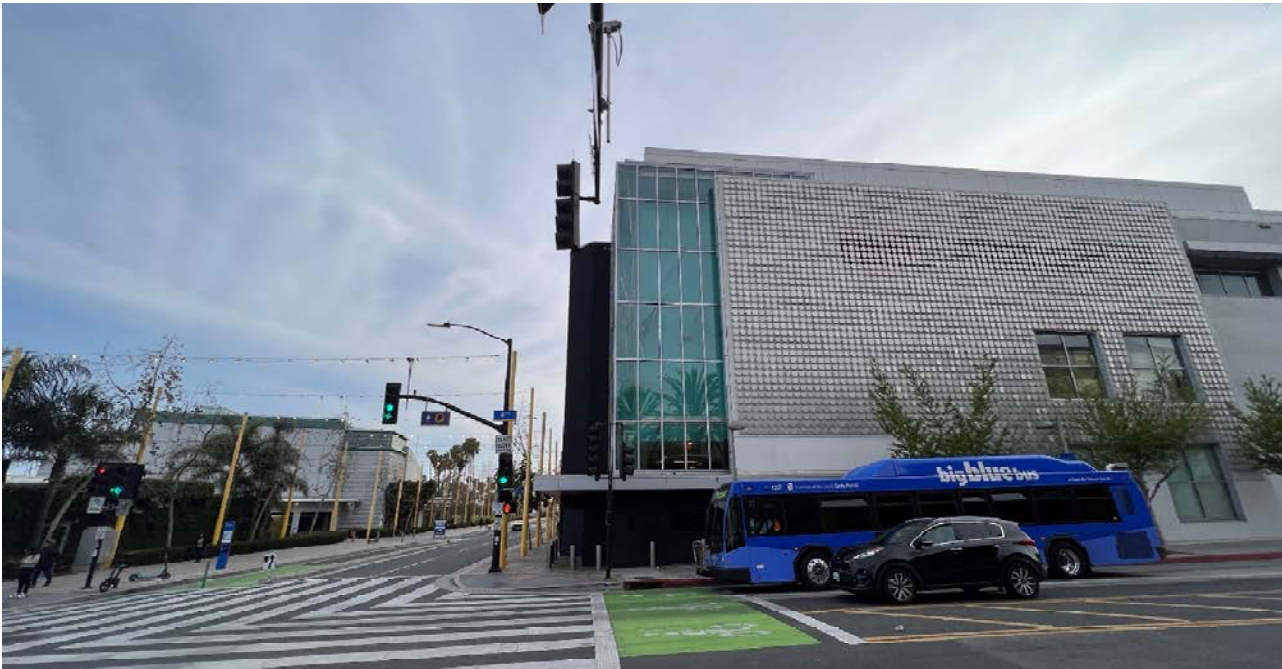


Figure 14: M-N5 – 4/18/2023, 6:37 pm



Figure 15: M-N5 – 4/18/2023, 8:37 pm

f. Monitoring Site M-E1:

Monitoring Site M-E1 is located at 302 Colorado, east Project property line, to evaluate the Project east elevations. The distance to the Project property line is approximately 71 feet.



Figure 16: M-E1 – 4/18/2023, 6:32 pm



Figure 17: M-E1 – 4/18/2023, 8:45 pm

g. Monitoring Site M-E2:

Monitoring Site M-E2 is located 203 ft. to the east of the northeast corner of Colorado and 4th St. east Project property line, to evaluate the Project east elevations. The distance to the Project property line is approximately 260 feet.



Figure 18: M-E2 – 3/5/2024, 11:06 am



Figure 19: M-E2 – 3/7/2024, 6:46 pm

h. Monitoring Site M-E3:

Monitoring Site M-E3 is located 250 ft diagonally to the Northeast of the northeast corner of Colorado Ave. and 4th St., east Project property line, to evaluate the Project east elevations. The distance to the Project property line is approximately 322 feet.



Figure 20: M-E3 – 3/5/2024, 11:07 pm



Figure 21: M-E3 – 3/7/2024, 6:52 pm

i. Monitoring Site M-S1:

Monitoring Site M-S1 is located at 120 Broadway, south Project property line, to evaluate the Project south elevations. The distance to the Project property line is approximately 90 feet.



Figure 22: M-S1 – 4/18/2023, 7:07 pm



Figure 23: M-S1 – 4/18/2023, 9:22 pm

j. Monitoring Site M-W1:

Monitoring Site M-W1 is located at 1457 3rd Street, west Project property line, to evaluate the Project west elevations. The distance to the Project property line is approximately 94 feet.



Figure 24: M-W1 – 4/18/2023, 6:55 pm



Figure 25: M-W1 – 4 /18/2023, 8:56 pm

k. Monitoring Site M-W2:

Monitoring Site M-W1 is located at 205 Broadway, west Project property line, to evaluate the Project west elevations. The distance to the Project property line is approximately 84 feet.



Figure 26: M-W2 – 4/18/2023, 7:00 pm



Figure 27: M-W2 – 4/18/2023, 9:05 pm

I. Monitoring Site M-W3:

Monitoring Site M-W3 is located at 107 Broadway, west Project property line, to evaluate the Project west elevations. The distance to the Project property line is approximately 330 feet.



Figure 28: M-W3 – 4/18/2023, 7:04 pm

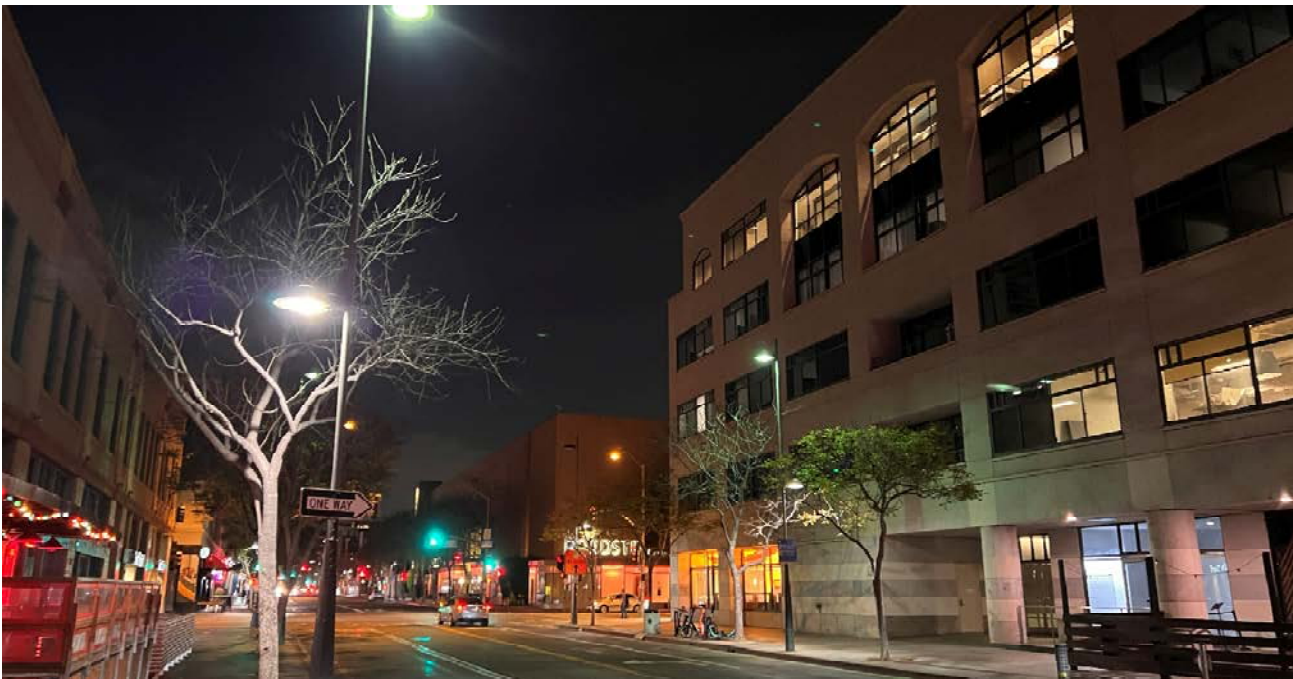


Figure 29: M-W1 – 4 /18/2023, 9:14 pm

9. LIGHTING ANALYSIS

The Project would introduce new Project Signs as described in Section 3 and depicted in Appendix A.

The following criteria are used to evaluate the Project Signs impacts with respect to light trespass and glare:

- Project Signs Light Trespass Illuminance must not exceed 0.74 fc at the Project property line and the property lines of adjacent residential properties or adjacent sensitive sites.
- Project Sign luminance visible from residential properties must be less than high contrast conditions, i.e., less than 30 to 1 contrast ratios.
- Project luminance visible within 10 degrees from the driver's normal field of view must be less 500 fL and or less than 1,000 times the minimum measured brightness in the driver's field of view, except that when the minimum measured brightness in the field of view is 10 footlamberts or less, the measured brightness of the light source in footlambert shall not exceed 500 plus 100 times the angle, in degrees, between the driver's field of view and the light source.

9.1 Light Trespass Analysis

Project light trespass illuminance from Project Signs is evaluated by way of the calculated illuminance (fc) as per the methodology defined in Section 7, at the vertical and horizontal calculation plane locations where lighting is under review. As noted above, this Study evaluates the light trespass illuminance from Project Signs with respect to lighting zone 3, maximum of 0.74 fc at adjacent sensitive use properties. This Study analyzes the proposed Project Signs as described in the Conceptual Plan (Appendix A) which defines the Project Sign locations, dimensions, and orientation.

The evaluation of illuminance as High, Medium, and Low describes the relative amount of light trespass at a sensitive use property at night. Illuminance greater than 0.74 fc, the maximum sign illuminance permitted by CEC is evaluated as "High". Illuminance greater than 0.30 fc but less than 0.74 fc is evaluated as "Medium". Illuminance, and illuminance less than 0.30 fc is evaluated as "Low".

As per the Project design features set forth in the Conceptual Plan, Project Signs will operate at maximum luminance of 6000 cd/m² during the day and 400 cd/m² at night with a smooth transition from day maximum luminance to night maximum luminance beginning 45 minutes prior to sunset and concluding at sunset, and from night maximum luminance to day maximum luminance from sunrise and concluding 45 minutes after sunrise.

The Project Sign light trespass analysis evaluates the illuminance (fc) from the Project Signs leaving the Project site toward adjacent sensitive use properties as shown in Figure 4 above with respect to the maximum light trespass threshold of 0.74 fc. Project Signs are analyzed in this Study conservatively with all Project Signs operating at maximum nighttime luminance as noted above, all white. The Project Signs will not operate at all white in practice; however, all white would produce the maximum light trespass and therefore is assumed to represent a conservative analysis. The information in the Conceptual Sign Plan (Appendix A) and as described in Section 3 (Project Description) was utilized to calculate Project Signs light trespass illuminance in this Study, with the calculation results presented in Table 5. Complete Project Signs illuminance calculated data is presented in Appendix H. Sign technical illustrations from the photometric study is presented in Appendix I.

The Project Signs maximum calculated vertical illuminance in Table 5 varies from a minimum of 0.02 fc at vertical plane VP-E1 to a maximum of 0.73 fc at vertical plane VP-W5 located at Vintage at 1449 4th Street. The calculated light trespass illuminance from Project Signs is less than the maximum 0.74 fc threshold in all locations.

Table 5: Project Signs Trespass Illuminance (fc)

Vertical Plane	Illuminance (fc)		CEC Analysis (0.74 fc threshold)
	Max	Avg	
VP-E1	0.02	0.01	Less than threshold
VP-E2	0.35	0.14	Less than threshold
VP-N1	0.29	0.26	Less than threshold
VP-N2	0.10	0.05	Less than threshold
VP-N3	0.43	0.24	Less than threshold
VP-N4	0.29	0.22	Less than threshold
VP-N5	0.14	0.03	Less than threshold
VP-N6	0.09	0.05	Less than threshold
VP-N7	0.14	0.07	Less than threshold
VP-W1	0.11	0.06	Less than threshold
VP-W2	0.09	0.06	Less than threshold
VP-W3	0.34	0.05	Less than threshold
VP-W4	0.17	0.06	Less than threshold
VP-W5	0.73	0.38	Less than threshold
VP-W6	0.11	0.06	Less than threshold

The Light Trespass Illuminance from Project Signs is less than the CEC threshold of 0.74 fc and will therefore not create a significant impact at the Monitoring Sites or at sensitive use properties adjacent to the Project site. Light degrades rapidly with distance as described above by the Inverse Square Law. Therefore, residential or other sensitive use properties more distant from the Project site than the Monitoring Sites will receive substantially less light trespass than the Monitoring Sites. Therefore, there is no significant light trespass impact from the Project Signs at any sensitive use or residential use properties.

9.2 Glare Analysis at Sensitive Use Properties

The evaluation of High, Medium and Low Contrast describes the perception of how bright a visible object appears in comparison to the surrounding objects within any given field of view. The "luminance ratio" is the ratio of the maximum Sign luminance as compared to the Average luminance within the field of view visible at an observer position. This ratio is referred to as "contrast", and is determined by the variation of luminance. "High," "Medium," and "Low" contrast are terms used to describe effect of the contrast ratios (the ratio of maximum luminance to the average within a field of view) of greater than 30:1, between 10:1 and 30:1, and below 10:1, respectively. Luminance contrast ratios above 30:1 are generally uncomfortable for the human eye to perceive. High Contrast, greater than a 30:1 Contrast Ratio, indicate a potential glare condition.

The existing lighting conditions at night within and surrounding the Project Site and visible within the field of view from the Monitoring Sites were evaluated on April 18, 2023 and March 5 & 6, 2024. Measurements of the existing luminance at night within the field of view from the Monitoring Sites are summarized in Section 7.3 and Table 4 above.

Potential glare from the Project Signs is evaluated by calculating the Contrast Ratio, which is the ratio of the maximum Sign luminance compared to the existing measured average luminance in Table 4. Table 6 summarizes the measured average luminance at each Monitoring Site (from Table 4) along with a calculation of the comparison of the proposed Project Signs maximum night time luminance to the existing measured average luminance to determine the Contrast Ratio.

Table 6: Project Signs Contrast Ratio

Monitoring Site	Existing Measured Luminance		Project Lighting Luminance		Evaluation
	Average	Maximum	Max	Contrast Ratio	
M-N1	106.4	907.5	400	3.8	Low Contrast, no Glare
M-N2	56.4	1005.0	400	7.1	Low Contrast, no Glare
M-N3	123.9	2042.0	400	3.2	Low Contrast, no Glare
M-N4	369.6	8872.0	400	1.1	Low Contrast, no Glare
M-N5	157.1	1656.0	400	2.5	Low Contrast, no Glare
M-E1	60.6	1242.0	400	6.6	Low Contrast, no Glare
M-E2	203.1	3716	400	2.0	Low Contrast, no Glare
M-E3	64.0	583	400	6.3	Low Contrast, no Glare
M-W1	216.2	3517.0	400	1.9	Low Contrast, no Glare
M-W2	134.0	2586.0	400	3.0	Low Contrast, no Glare
M-W3	342.1	4492.0	400	1.2	Low Contrast, no Glare
M-S1	497.6	7350.0	400	0.8	Low Contrast, no Glare

The existing measured average luminance in Table 6 is Monitoring site M-N2 M-E1, and M-E3 is less than 100 cd/m², and the maximum Project Sign night time luminance results in a Contrast Ratio of 6.6:1 at M-E1 and 7.1:1 at M-N2, both of which are low contrast and will not produce glare.

The existing measured luminance at Monitoring Sites M-N1, M-N3, M-N4, M-N5, M-E2, M-W1, M-W2, and M-W3 are greater than 100 cd/m² and less than 400 cd/m², and the existing measured luminance at Monitoring Site M-S1 is greater than 400 cd/m².

The maximum Project Sign nighttime luminance of 400 cd/m² results in low Contrast Ratios for all Monitoring Sites, from a minimum of 0.8:1, to a maximum of 7.1:1.

Therefore, the proposed Project Sign maximum night time luminance at 400 cd/m² will not create a new source of glare at the Monitoring Sites or at surrounding residential properties adjacent to the Project Site. Light degrades rapidly with distance as described above by the Inverse Square Law. Therefore, residential properties more distant from the Project Site than the Monitoring Sites will receive substantially less light than the Monitoring Sites. Therefore, there is no significant glare impact from the Project Signs at any residential use properties.

None of the Project Signs are visible from M-N3, M-N4, M-N5, and M-W2 as stated in Table 2 above. The calculated illuminance values are less than the threshold at the rest of the Monitoring Sites where signs are partially or fully visible as stated in Table 2 above.

9.3 Glare Analysis for Roadways, California Vehicle Code

The lighting impact to driver's visibility from the Project Signs is evaluated by way of the methodology defined in Section 7 above at the center line of the driver's field of view and at angles wider than the center line of the driver's field of view.

Bright sources within the drivers field of view, from the centerline of the roadway to angles up to 90 degrees from the center line of the roadway, may create glare if the light source is brighter than the limits established by the California Vehicle Code as noted in Section 5.2 above. As summarized below, the results of this Study demonstrate the maximum Project Sign luminance is less than the limits established by the California Vehicle Code for excessive luminance, or glare, during night, twilight (after sunset, and before sunrise), and during the day. Accordingly, the Project Signs meet the California Vehicle Code standard for roadways approaching the Project Site from all directions.

The roadway glare analysis evaluates the maximum Project Sign luminance during night, twilight, and day with respect to the most stringent requirements of the California Vehicle Code to determine if the Project introduces a source of distracting glare to drivers. The maximum Project luminance at night and during twilight includes the Project Signs operating at the maximum night luminance of 400 cd/m², all white. The maximum Project Sign luminance during the day includes the Project Signs operating at the maximum daytime luminance of 6000 cd/m², all-white.

The most stringent condition identified within the California Vehicle Code Section 21466.5, states: "except that when the minimum measured brightness in the field of view is 10 footlamberts or less, the measured brightness of the light source in footlamberts (fL) shall not exceed 500 plus 100 times the angle, in roadway degrees, between the driver's field of view and the light source." Thus, a conservative evaluation occurs where the Project Signs are visible within the centerline of the driver's field of view, the angle noted above within the field of view is 0, the surrounding surface luminance is less than 10 fL, and therefore the maximum allowable luminance is 500 fL. Therefore, the most conservative condition at night or at twilight evaluates the Project Signs maximum luminance against a maximum luminance threshold of 500 fL.

9.4 Night

A measured brightness within the driver's field of view of less than 10 fL may occur at night. The maximum Project Sign luminance during night is 400 cd/m². Calculating the equivalent maximum luminance by converting to english units from metric units: 400 cd/m² equals 116.7 fL. Because the Project Signs are proposed to be limited to a maximum night time luminance of 400 cd/m², or 116.7 fL, the Project Sign maximum luminance will not exceed 116.7 fL, which is 23.3% of the 500 fL maximum, the most conservative limit stipulated by the California Vehicle Code for conditions where the minimum brightness in the driver's field of view is less than 10 fL. Therefore, at night the Project Signs within the drivers field of view will not exceed the 500 fL threshold and will not introduce a new source of glare as defined by the California Vehicle Code Section 21466.5.

For Project Signs located beyond the driver's 10 degree field of view the maximum luminance is permitted to increase under the California Vehicle Code. For example, light sources located 15 degrees from the centerline of the driver's field of view would be limited to a maximum of 1,000 fL (500 fL plus 100 times the angle (5 degrees) = 1,000 fL). The maximum Project Sign luminance is 400 cd/m² or 116.7 fL at night, or less than approximately 23.3% of the maximum allowed by the California Vehicle code for those Project Sign locations at 15 degrees from the center of the driver's field of view. Therefore, at night the Project Signs beyond the drivers 10 degree field of view will not exceed the 1000 fL threshold and will not introduce a new source of glare as defined by the California Vehicle Code Section 21466.5.

9.5 Twilight

The Project Signs are also evaluated during twilight (the transition period from day to night, from sunset to 45 minutes after sunset, and night to day, from 45 minutes before sunrise to sunrise). Sunlight increases gradually from the minimum brightness at sunrise to maximum brightness at mid-day, and then decreases gradually to the minimum brightness at sunset. Therefore, the minimum ambient sunlight occurs after sunset or before sunrise. However, in order to analyze the most conservative, low level sunlight conditions, this analysis adjusts the time frame for the minimum ambient luminance condition of 10 fL to sunset and at sunrise, extending the duration of minimum sunlight. At sunset the ambient sunlight will be greater than the minimum values after sunset during twilight, and at sunrise the luminance will be greater than the minimum during the time preceding sunrise. At sunset or sunrise, the minimum luminance values within the driver's field of view will be above the minimum night time values (10fL) due to the light from the setting or rising sun. However, to maintain a conservative analysis, this evaluation assumes the minimum luminance within the driver's field of view will be less

than 10 fL from sunset until sunrise. Therefore, the maximum luminance during twilight will remain at 500 fL during twilight. The maximum luminance permitted by the California Vehicle Code of 500 fL, which converting to metric units, equals 1579 cd/m², which is far greater than the proposed 400 cd/m² maximum Project Sign luminance.

The Project Signs are designed to operate at 400 cd/m² (116.7 fL) maximum luminance, from sunset to sunrise. At 45 minutes prior to sunset the Project Signs are specified to begin transition from the maximum daytime luminance of 6,000 cd/m² to the maximum nighttime luminance of 400 candelas/m². This transition must be completed no later than sunset to avoid potential high contrast, glare conditions. Similarly, the Project Signs are specified to transition from the night maximum luminance of 400 cd/m² to the day maximum luminance of 6,000 cd/m², beginning no earlier than sunrise. Therefore, the Project Signs will not exceed a maximum luminance of 400 cd/m² from sunset to sunrise, which converts to a maximum of 116.7 fL, less than the maximum permitted luminance of 500 fL. Thus, the Project Signs will not exceed the threshold of 500 fL, and will therefore not introduce a new source of glare, during twilight.

9.6 Day

The evaluation of the Project Signs during the day (45 minutes after sunrise until 45 minutes before sunset) compares the daytime, ambient brightness to the maximum sign brightness stipulated by the California Vehicle Code during full sun conditions and overcast sky conditions. The California Vehicle Code, Section 21466.5 referenced above permits the Project Signs to "generate light intensity levels greater than 1,000 times the minimum measured brightness in the driver's field of view, except when the minimum values are less than 10 (fL)."

During the day (45 minutes after sunrise until 45 minutes before sunset) sunlight with clear sky conditions or light overcast conditions provides sufficient illuminance to generate surface brightness greater than 10 fL and up to 1200 fL on the least reflective surfaces, such as roadway pavement. Utilizing the value of 10 fL as the minimum within the driver's field of view, the maximum allowable brightness would be 1,000 times 10 fL, or 10,000 fL. Because the Project Signs would be, as a project design feature, limited to a maximum luminance of 6,000 cd/m² (1,751 fL) during the daytime hours of operation, Project Signs will not exceed 6,000 cd/m² (1,751 fL) during the day, and Project Signs will therefore operate at less than 18% of the maximum luminance stipulated by the California Vehicle Code. Therefore, the Project Signs will not create a new source of glare during day time hours of operation with clear sky or light overcast conditions.

Severe storms, heavy cloud cover, or other atmospheric conditions may occur during the day, which may cause the minimum brightness within the driver's field of view to be less than 10 fL. The Project Signs are proposed to include an electronic control system to reduce the sign luminance from 6,000 cd/m² (1,751 fL) to 400 candelas/m² (116.7 fL) maximum when the ambient sun light falls to illuminance values similar to night, less than 100 fc. During the day, when storms, cloud cover, or other low ambient sunlight conditions occur and when the ambient sunlight is less than 100 fc, the Project Signs will transition from the daytime 6,000 cd/m² (1,751 fL) to 400 candelas/m² (116.7 fL) maximum, and thereby ensure that the sign brightness remains less than the maximum brightness stipulated by the California Vehicle Code. Therefore, the Project Signs will not create a new source of glare during day time periods with storm or severe overcast weather conditions and will not exceed 116.7 fL, or 23.3% of the 500 fL maximum allowed by the California Vehicle Code during overcast conditions.

The Project Signs are designed to not exceed 400 candelas/m² (116.7 fL) luminance at night, twilight, or during overcast sky conditions, and Project Signs will not exceed 6,000 cd/m² (1,751 fL) during the day. The Project Sign luminance is thus less than the California Vehicle Code standard, including 23.3% of the maximum allowable luminance identified as the threshold for glare during the day, therefore the Project Signs will not create a new source of glare.

10. CONCLUSIONS

This Study confirms the light resulting from Project Signs will be less than the significance thresholds defined by the CEC at 0.74 fc at sensitive use properties and, less than 30 to 1 contrast ratio. Therefore, there is no impact from the Project Signs at surrounding sensitive use properties adjacent to the Project. Light intensity degrades exponentially with distance.

Therefore, sensitive use properties which are more distant than the locations analyzed in this Study will receive substantially less light from the Project Signs. Therefore, there is no significant impact from the Project Signs at sensitive use properties. In addition, the light from Project Signs will not exceed the maximum defined by the California Vehicle Code, and there is no significant impact from the Project Signs with respect to driver's glare.

APPENDIX A: CONCEPTUAL SIGN PLAN

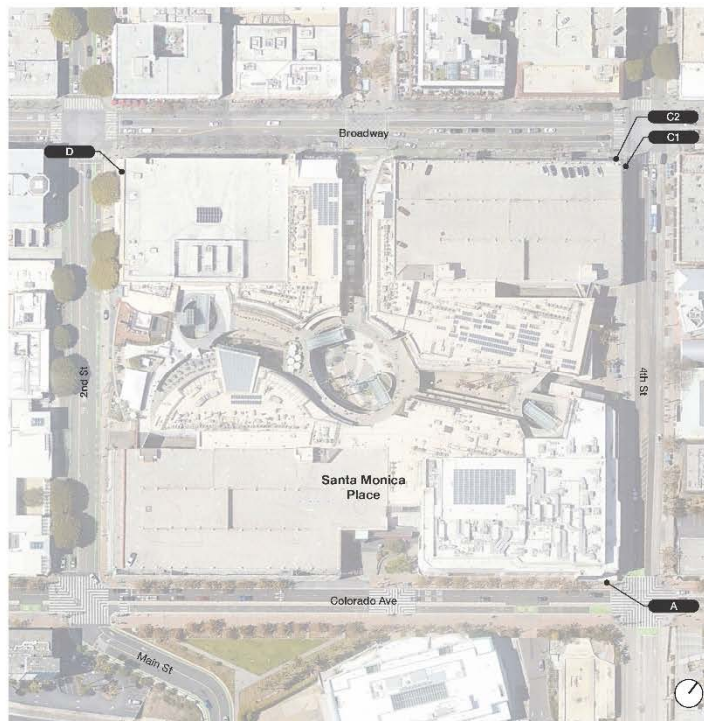
Macerich Santa Monica Place New Exterior Displays

Santa Monica Place
Santa Monica, CA 90401

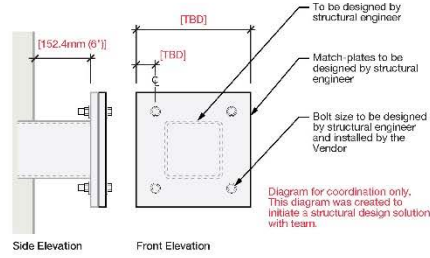
Dynamic Real Estate™
August 17, 2023

Asset Plan: New Exterior Displays

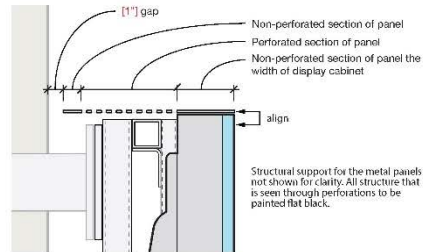
ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq/ft)
A	New Exterior Wall-Mounted LED Digital Display	30'W x 30'H	8	1	900
C1	New Exterior Wall-Mounted LED Digital Display	27'W x 20'H	8	1	540
C2	New Exterior Wall-Mounted LED Digital Display	25'W x 20'H	8	1	500
D	New Exterior Wall-Mounted LED Digital Display	29'W x 26'H	8	1	754



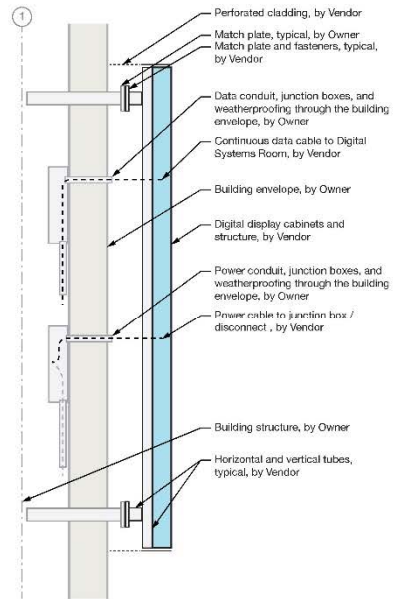
Handoff Diagrams



01 Structural Match Plate Coordination Diagram: 1 1/2" = 1'-0"

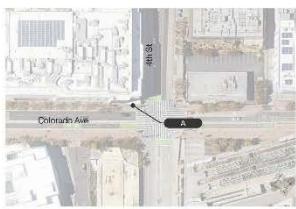


02 Custom Cladding Perforation Considerations: 1 1/2" = 1'-0"



03 Program and Assessment Scope Demarcation Diagram: 1/2" = 1'-0"

Location A Existing



Location A

ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq ft)
A	New Exterior Wall-Mounted LED Digital Display	30'W x 30'H	8	1	900



Before

Sensory Interactive

New Exterior Displays Santa Monica Place August 17, 2023

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Location A

ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq ft)
A	New Exterior Wall-Mounted LED Digital Display	30'W x 30'H	8	1	900



Before

Sensory Interactive

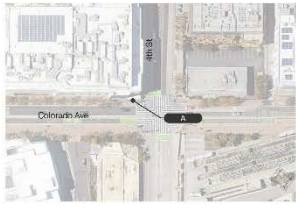
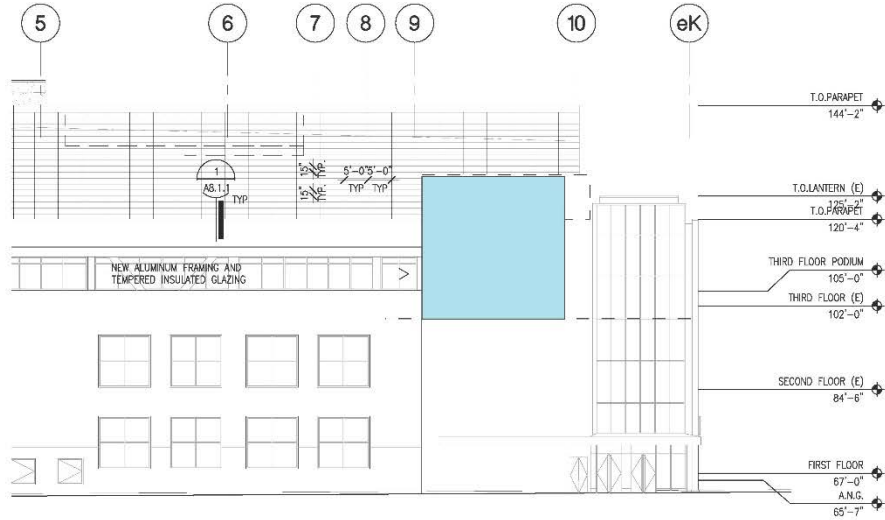
New Exterior Displays Santa Monica Place August 17, 2023

6

Location A

ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq ft)
A	New Exterior Wall Mounted LED Digital Display	30'W x 30'H	8	1	900

• Location depicts extending existing stair tower enclosure up +/- 9' to enclose display structure.



Key Plan

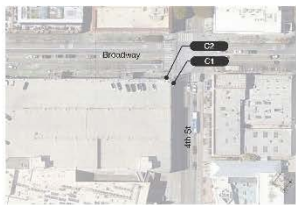
Colorado Ave. Elevation Scale 1/16" = 1'-0"

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7

Location C Existing



Key Plan

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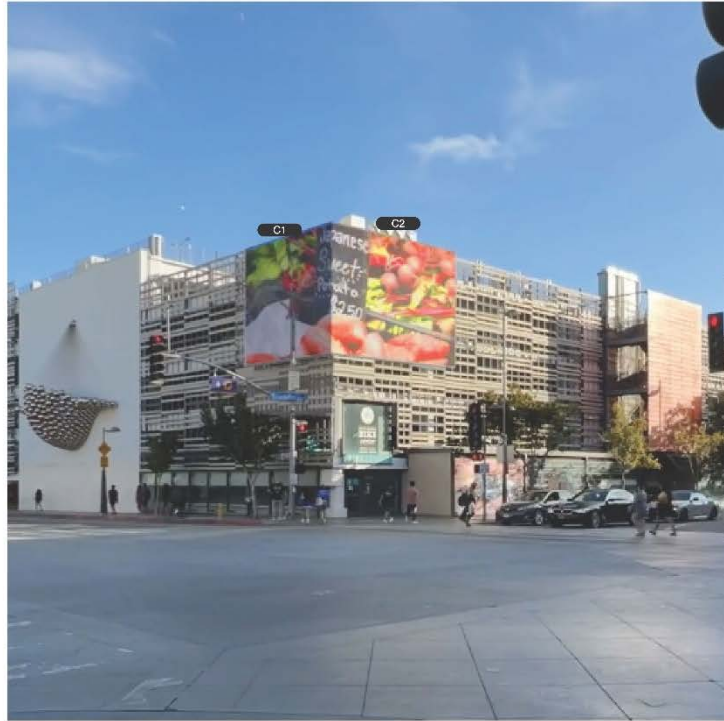
New Exterior Displays Santa Monica Place August 17, 2023

8

Location C

ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq ft)
C1	New Exterior Wall-Mounted LED Digital Display	27'W x 20'H	8	1	540
C2		25'W x 20'H	8	1	500

- Options depict removing existing metal screen and structure.



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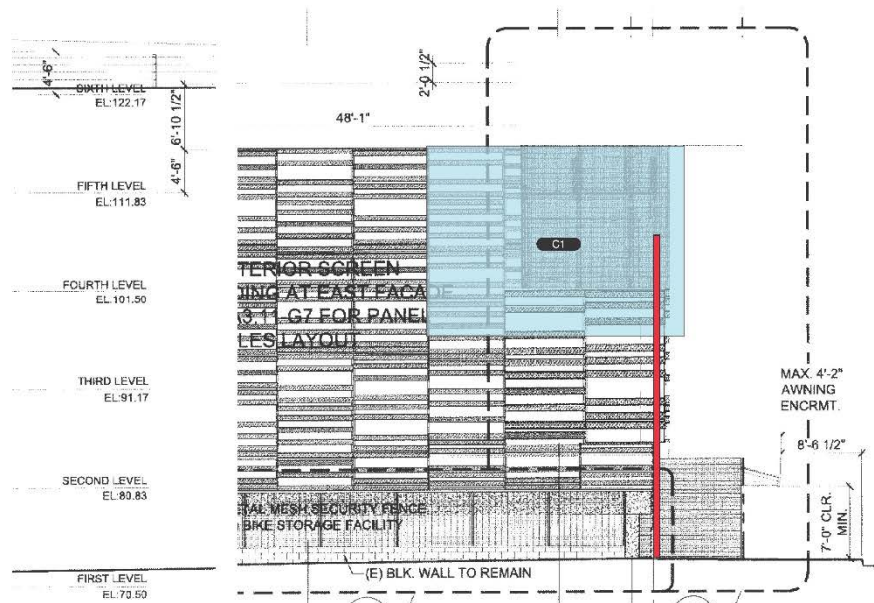
9

Location C

ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq ft)
C1	New Exterior Wall-Mounted LED Digital Display	27'W x 20'H	8	1	540
C2		25'W x 20'H	8	1	500



Key Plan



4th St Elevation Scale 1/8" = 1'-0"

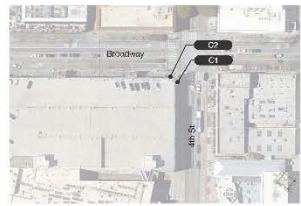
Sensory Interactive

New Exterior Displays Santa Monica Place August 17, 2023

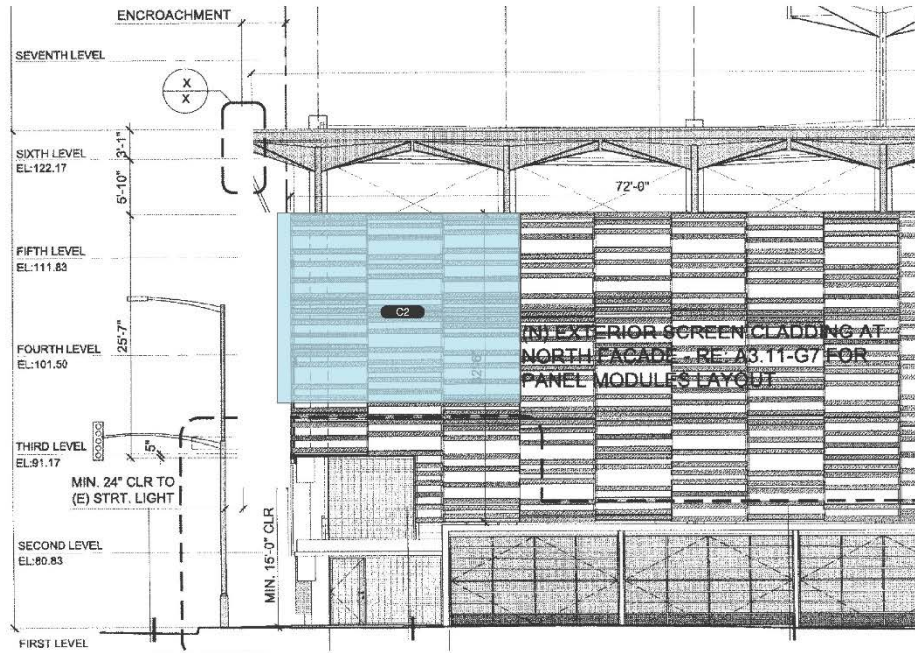
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Location C

ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq ft)
C1	New Exterior Wall Mounted LED Digital Display	27'W x 20'H	8	1	540
C2		25'W x 20'H	8	1	500



Key Plan



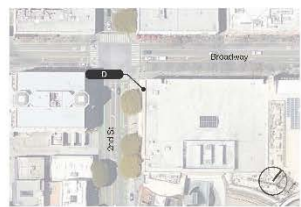
Broadway Elevation Scale 1/8" = 1'-0"

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New Exterior Displays Santa Monica Place August 17, 2023

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Location D Existing



Key Plan



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New Exterior Displays Santa Monica Place August 17, 2023

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Location D

ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq ft)
D	New Exterior Walk Mounted LED Digital Corner Display	29'W x 26'H	8	1	754

- Minimize incursion to tenant space by removing brick facade at stub out locations back to building structure. Surface mount displays. Architectural trim or additional surround treatment to be determined by architects.
- Structural to determine dimensioned take-off points and framing needs to allow for architectural cladding or additional surround treatment.



Before

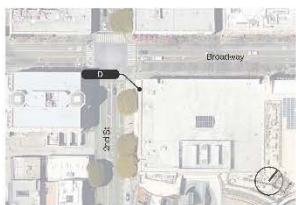
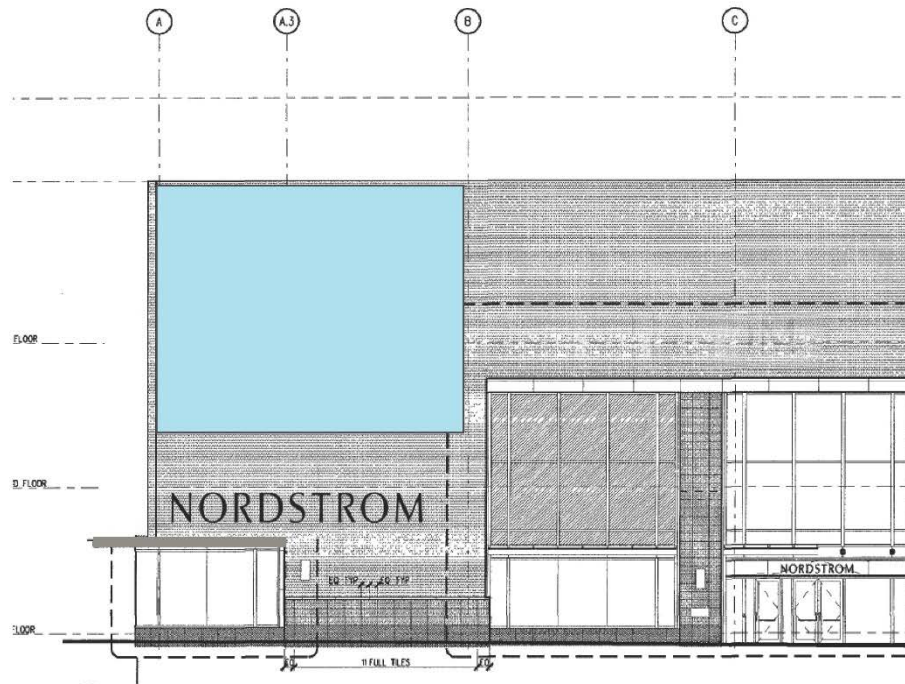
Sensory Interactive

New Exterior Displays Santa Monica Place August 17, 2023

13

Location D

ID	Asset	Size (W x H)	Pixel Pitch	Qty.	Area (sq ft)
D	New Exterior Walk Mounted LED Digital Corner Display	29'W x 26'H	8	1	754



Key Plan

Elevation Scale 1/8" = 1'-0"

Sensory Interactive

New Exterior Displays Santa Monica Place August 17, 2023

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APPENDIX B: 2019 California Administrative Code, Section 10-114
10-114 – DETERMINATION OF OUTDOOR LIGHTING ZONES AND ADMINISTRATIVE RULES FOR USE

This section establishes rules for implementing outdoor lighting zones to show compliance with Section 140.7 of Title 24, California Code of Regulations, Part 6.

- (a) **Lighting Zones.** Exterior lighting allowances in California vary by Lighting Zones (LZ).
- (b) **Lighting Zone Characteristics.** TABLE 10-114-A specifies the relative ambient illumination level and the statewide default location for each lighting zone.
- (c) **Amending the Lighting Zone Designation.** A local jurisdiction may officially adopt changes to the lighting zone designation of an area by following a public process that allows for formal public notification, review, and comment about the proposed change. The local jurisdiction may determine areas where Lighting Zone 4 is applicable and may increase or decrease the lighting zones for areas that are in State Default Lighting Zones 1, 2 and 3, as specified in TABLE 10-114-A.

TABLE 10-114-A LIGHTING ZONE CHARACTERISTICS AND RULES FOR AMENDMENTS BY LOCAL JURISDICTIONS

Zone	Ambient Illumination	State wide Default Location	Moving Up to Higher Zones	Moving Down to Lower Zones
LZ0	Very Low	Undeveloped areas of government designated parks, recreation areas, and wildlife preserves.	Undeveloped areas of government designated parks, recreation areas, and wildlife preserves can be designated as LZ1 or LZ2 if they are contained within such a zone.	Not applicable
LZ1	Low	Rural areas, as defined by the 2010 U.S. Census. These areas include: single or dual family residential areas, parks, and agricultural zone districts, developed portion of government designated parks, recreation areas, and wildlife preserves. Those that are wholly contained within a higher lighting zone may be considered by the local government as part of that lighting zone.	Developed portion of a government designated park, recreation area, or wildlife preserve, can be designated as LZ2 or LZ3 if they are contained within such a zone. Retail stores, located in a residential neighborhood, and rural town centers, as defined by the 2010 U.S. Census, can be designated as LZ2 if the business operates during hours of darkness.	Not applicable.
LZ2	Moderate	Urban clusters, as defined by the 2010 U.S. Census. The following building types may occur here: multifamily housing, mixed use residential neighborhoods, religious facilities, schools, and light commercial business districts or industrial zoning districts.	Special districts within a default LZ2 zone may be designated as LZ3 or LZ4 by a local jurisdiction. Examples include special commercial districts or areas with special security considerations located within a mixed-use residential area or city center.	Special districts may be designated as LZ1 by the local jurisdiction, without any size limits.
LZ3	Moderately High	Urban areas, as defined by the 2010 U.S. Census. The following building types may occur here: high intensity commercial corridors, entertainment centers, and heavy industrial or manufacturing zone districts.	Special districts within a default LZ3 may be designated as a LZ4 by local jurisdiction for high intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels.	Special districts may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
LZ4	High	None.	Not applicable.	Not applicable.

NOTE: Authority: Sections 25402 and 25402.1, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, Public Resources Code.

10-114 – DETERMINATION OF OUTDOOR LIGHTING ZONES AND ADMINISTRATIVE RULES FOR USE

APPENDIX C: 2022 California Energy Code, Section 140.7 Prescriptive Requirements for Outdoor Lighting

SECTION 140.7 – PRESCRIPTIVE REQUIREMENTS FOR OUTDOOR LIGHTING

(a) An outdoor lighting installation complies with this section if it meets the requirements in Subsections (b) and (c), and the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Subsection (d). The allowed outdoor lighting shall be calculated according to outdoor lighting zone in Title 24, Part 1, Section 10-114.

Exceptions to Section 140.7(a): When more than 50 percent of the light from a luminaire falls within one or more of the following applications, the lighting power for that luminaire shall be exempt from Section 140.7:

1. Temporary outdoor lighting.
2. Lighting required and regulated by the Federal Aviation Administration, and the Coast Guard.
3. Lighting for public streets, roadways, highways and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.
4. Lighting for sports and athletic fields, and children's playgrounds.
5. Lighting for industrial sites, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
6. Lighting of public monuments.
7. Lighting of signs complying with the requirements of Sections 130.3 and 140.8.
8. Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.
9. Landscape lighting.
10. In theme parks: outdoor lighting only for themes and special effects.
11. Lighting for outdoor theatrical and other outdoor live performances, provided that these lighting systems are additions to area lighting systems and are controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.
12. Outdoor lighting systems for qualified historic buildings, as defined in the California Historic Building Code (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section 140.7.

(b) **Outdoor lighting power trade-offs.** Outdoor lighting power trade-offs shall be determined as follows:

1. Allowed lighting power determined according to Section 140.7(d)1 for general hardscape lighting allowance may be traded to specific applications in Section 140.7(d)2, provided the hardscape area from which the lighting power is traded continues to be illuminated in accordance with Section 140.7(d)1A.
2. Allowed lighting power determined according to Section 140.7(d)2 for additional lighting power allowances for specific applications shall not be traded between specific applications, or to hardscape lighting in Section 140.7(d)1.
3. Trading of lighting power allowances between outdoor and indoor areas shall not be permitted.

(c) **Calculation of actual lighting power.** The wattage of outdoor luminaires shall be determined in accordance with Section 130.0(c).

(d) **Calculation of allowed lighting power.** The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with Section 140.7(d)1, and the sum of the additional lighting power allowance for specific applications determined in accordance with Section 140.7(d)2.

1. **General hardscape lighting allowance.** Determine the general hardscape lighting power allowances as follows:
 - A. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is ten times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the area wattage allowance (AWA) from Table 140.7-A for the appropriate lighting zone.
 - B. Determine the perimeter length of the general hardscape area. The total perimeter shall not include portions of hardscape that are not illuminated according to Section 140.7(d)1A. Multiply the hardscape perimeter by the linear wattage allowance (LWA) for hardscape from Table 140.7-A for the appropriate lighting zone. The perimeter length for hardscape around landscaped areas and permanent planters shall be determined as follows:
 - i. Landscaped areas completely enclosed within the hardscape area, and which have a width or length less than 10 feet wide, shall not be added to the hardscape perimeter length.
 - ii. Landscaped areas completely enclosed within the hardscape area, and which width or length is a minimum of 10 feet wide, the perimeter of the landscaped areas or permanent planter shall be added to the hardscape perimeter length.
 - iii. Landscaped edges that are not abutting the hardscape shall not be added to the hardscape perimeter length.
 - C. Determine the Initial Wattage Allowance (IWA) for general hardscape lighting from Table 140.7-A for the appropriate lighting zone. The hardscape area shall be permitted one IWA per site.
 - D. The general hardscape lighting allowance shall be the sum of the allowed watts determined from (A), (B) and (C) above.
2. **Additional lighting power allowance for specific applications.** Additional lighting power for specific applications shall be the smaller of the additional lighting allowances for specific applications determined in accordance with Table 140.7-B for the appropriate lighting zone, or the actual installed lighting power meeting the requirements for the allowance.

TABLE 140.7-A GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE

Type of Power Allowance	Lighting Zone 0 ³	Lighting Zone 1 ³	Lighting Zone 2 ³	Lighting Zone 3 ³	Lighting Zone 4 ³
Area Wattage Allowance (AWA)	No allowance ¹	0.016 W/ft ²	0.019 W/ft ²	0.021 W/ft ²	0.024 W/ft ²
Linear Wattage Allowance (LWA)	No allowance ¹	0.13 W/lf	0.15 W/lf	0.20 W/lf	0.29 W/lf
Initial Wattage Allowance (IWA)	No allowance ¹	150 W	200 W	250 W	320 W

¹ Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 Watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse, or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed shall meet the maximum zonal lumen limits as specified in Section 130.2(b).

² RESERVED.

³ Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm – as mandated by local, state, or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna – shall be allowed a 2.0 lighting power allowance multiplier.

 SECTION 140.7 – PRESCRIPTIVE REQUIREMENTS FOR OUTDOOR LIGHTING

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.					
Building Entrances or Exits. Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	Not applicable	9 watts	15 watts	19 watts	21 watts
Primary Entrances to Senior Care Facilities, Police Stations, Healthcare Facilities, Fire Stations, and Emergency Vehicle Facilities. Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	Not applicable	20 watts	40 watts	57 watts	60 watts
Drive Up Windows. Allowance per customer service location. Luminaires qualifying for this allowance shall be within 2 mounting heights of the sill of the window.	Not applicable	16 watts	30 watts	50 watts	75 watts
Vehicle Service Station Uncovered Fuel Dispenser. Allowance per fueling dispenser. Luminaires qualifying for this allowance shall be within 2 mounting heights of the dispenser.	Not applicable	55 watts	77 watts	81 watts	135 watts
ATM Machine Lighting. Allowance per ATM machine. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser.	Not applicable	100 watts for first ATM machine, 35 watts for each additional ATM machine.			
WATTAGE ALLOWANCE PER UNIT LENGTH (w/linear ft). May be used for one or two frontage side(s) per site.					
Outdoor Sales Frontage. Allowance for frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	Not applicable	No Allowance	11 W/linear ft	19 W/linear ft	25 W/linear ft
WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.					
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 50 watts or less as determined in accordance with Section 130.0(c), and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers.	Not applicable	No Allowance	0.007 W/ft ²	0.013 W/ft ²	0.019 W/ft ²
WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft²). Use as appropriate provided that none of the following specific applications shall be used for the same area.					
Building Facades. Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects.	Not applicable	No Allowance	0.100 W/ft ²	0.170 W/ft ²	0.225 W/ft ²
Outdoor Sales Lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other non-sales areas shall be considered hardscape areas even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within 5 mounting heights of the sales lot area.	Not applicable	0.060 W/ft ²	0.210 W/ft ²	0.280 W/ft ²	0.485 W/ft ²
Vehicle Service Station Hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure.	Not applicable	0.006 W/ft ²	0.068 W/ft ²	0.138 W/ft ²	0.200 W/ft ²
Vehicle Service Station Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not applicable	0.220 W/ft ²	0.430 W/ft ²	0.580 W/ft ²	1.010 W/ft ²

SECTION 140.7 – PRESCRIPTIVE REQUIREMENTS FOR OUTDOOR LIGHTING

Sales Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not applicable	No Allowance	0.470 W/ft ²	0.622 W/ft ²	0.740 W/ft ²
Non-sales Canopies and Tunnels. Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel.	Not applicable	0.057 W/ft ²	0.137 W/ft ²	0.270 W/ft ²	0.370 W/ft ²
Guard Stations. Allowance up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse.	Not applicable	0.081 W/ft ²	0.176 W/ft ²	0.325 W/ft ²	0.425 W/ft ²
Student Pick-up/Drop-off zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked-up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within 2 mounting heights of the student pick-up/drop-off zone.	Not applicable	No Allowance	0.056 W/ft ²	0.200 W/ft ²	No Allowance
Outdoor Dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.	Not applicable	0.004 W/ft ²	0.030 W/ft ²	0.050 W/ft ²	0.075 W/ft ²
Special Security Lighting for Retail Parking and Pedestrian Hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	Not applicable	0.004 W/ft ²	0.005 W/ft ²	0.010 W/ft ²	No Allowance
Security Cameras. This additional allowance is for illuminated general hardscape area. This allowance shall apply when a security camera is installed within 2 mounting heights of the general hardscape area and mounted more than 10 feet away from a building.	Not applicable	No Allowance	0.018 W/ft ²	0.018 W/ft ²	0.018 W/ft ²

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, Public Resources Code.

 SECTION 140.7 – PRESCRIPTIVE REQUIREMENTS FOR OUTDOOR LIGHTING

APPENDIX D: 2022 California Energy Code, Section 130.3 Sign Lighting Controls

SECTION 130.3 – SIGN LIGHTING CONTROLS

Nonresidential buildings other than healthcare facilities and hotel/motel buildings shall comply with the applicable requirements of Sections 130.3(a)1 through 130.3(a)3.

(a) **Controls for sign lighting.** All sign lighting shall meet the requirements below as applicable:

1. **Indoor signs.** All indoor sign lighting other than exit sign lighting shall be controlled with an automatic time-switch control or astronomical time-switch control.
2. **Outdoor signs.** Outdoor sign lighting shall meet the following requirements as applicable:
 - A. All outdoor sign lighting shall be controlled with a photocontrol in addition to an automatic time-switch control, or an astronomical time-switch control.

Exception to Section 130.3(a)2A: Outdoor signs in tunnels, and signs in large permanently covered outdoor areas that are intended to be continuously lit, 24 hours per day and 365 days per year.
 - B. All outdoor sign lighting that is ON both day and night shall be controlled with a dimmer that provides the ability to automatically reduce sign lighting power by a minimum of 65 percent during nighttime hours. Signs that are illuminated at night and for more than 1 hour during daylight hours shall be considered ON both day and night.

Exception to Section 130.3(a)2B: Outdoor signs in tunnels and large covered areas that are intended to be illuminated both day and night.
3. **Demand responsive Electronic Message Center (EMC) control.** See Section 110.12 for requirements for demand responsive EMC controls.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, Public Resources Code.

APPENDIX E: 2019 California Energy Code, Section 140.8 Prescriptive Requirements for Signs

SECTION 140.8 – PRESCRIPTIVE REQUIREMENTS FOR SIGNS

This section applies to all internally illuminated and externally illuminated signs, unfiltered light emitting diodes (LEDs), and unfiltered neon, both indoor and outdoor. Each sign shall comply with either Subsection (a) or (b), as applicable.

(a) Maximum allowed lighting power.

1. For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.
2. For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.
3. Lighting for unfiltered light emitting diodes (LEDs) and unfiltered neon shall comply with Section 140.8(b).

(b) Alternate lighting sources. The sign shall be equipped with one or more of the following light sources:

1. High pressure sodium lamps; or
2. Metal halide lamps that are:
 - A. Pulse start or ceramic served by a ballast that has a minimum efficiency of 88 percent or greater, or
 - B. Pulse start that are 320 watts or smaller, are not 250 watt or 175 watt lamps, and are served by a ballast that has a minimum efficiency of 80 percent.

Ballast efficiency is the reference lamp power divided by the ballast input power when tested according to ANSI C82.6-2015.

3. Neon or cold cathode lamps with transformer or power supply efficiency greater than or equal to the following:
 - A. A minimum efficiency of 75 percent when the transformer or power supply rated output current is less than 50 mA; or
 - B. A minimum efficiency of 68 percent when the transformer or power supply rated output current is 50 mA or greater.

The ratio of the output wattage to the input wattage is at 100 percent tubing load.

4. Fluorescent lighting systems meeting one of the following requirements:
 - A. Use only lamps with a minimum color rendering index (CRI) of 80; or
 - B. Use only electronic ballasts with a fundamental output frequency not less than 20 kHz.
5. Light emitting diodes (LEDs) with a power supply having an efficiency of 80 percent or greater; or

Exception to Section 140.8(b)5: Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output, and have a nameplate output power less than or equal to 250 watts, shall comply with the applicable requirements of the appliance efficiency regulations Appliance Efficiency Regulations (Title 20).

6. Compact fluorescent lamps that do not contain a medium screw base socket (E24/E26).

Exception 1 to Section 140.8: Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign or an externally illuminated sign.

Exception 2 to Section 140.8: Exit signs. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.

Exception 3 to Section 140.8: Traffic Signs. Traffic signs shall meet the requirements of the Appliance Efficiency Regulations.

APPENDIX F: ANSI/IES RP-8-22, Table 4.1, Nighttime Outdoor Lighting Zone Definitions

Obtrusive Light

4.3.1 Recommended Acceptable Levels of Spill Light. The IES and the IDA together have defined maximum levels of spill light within given areas of ambient brightness. Known as lighting zones (LZ), these area classifications are being recognized and utilized by professional organizations and adopted in lighting ordinances. ANSI/IES LP-11-20² and the IES/IDA Model Lighting Ordinance⁴ provide guidance for developing a community lighting ordinance.

Areas are classified into one of five LZs, ranging from LZ-0, the most restrictive, to LZ-4, the least restrictive, as shown in **Table 4-1**. (Refer to ANSI/IES LP-11-20² for in-depth discussion on lighting zones, including a discussion on “How to Use Lighting Zones,” and frequently asked questions that need to be addressed whenever the use of lighting zones is proposed.)

Recommended acceptable maximum initial illuminance levels of light trespass based on LZs are shown in **Table 4-2**.

Table 4-1. Lighting Zones

Zone	Recommended Uses or Areas	Considerations
0	Lighting Zone 0 should be applied to areas in which permanent lighting is not expected and when used, is limited in the amount of lighting and the period of operation. LZ-0 typically includes undeveloped areas of open space, wilderness parks and preserves, areas near astronomical observatories, or any other area where the protection of a dark environment is critical. Special review should be required for any permanent lighting in this zone. Some rural communities may choose to adopt LZ-0.	Recommended default zone for wilderness areas, parks and preserves, and undeveloped rural areas. Includes protected wildlife areas and corridors.
1	Lighting Zone 1 pertains to areas that desire low ambient lighting levels. These typically include single and two family residential communities, rural town centers, business parks, and other commercial or industrial/storage areas typically with limited nighttime activity. May also include the developed areas in parks and other natural settings.	Recommended default zone for rural and low density residential areas. Includes residential single or two family; agricultural zone districts; rural residential zone districts; business parks; open space include open space include preserves in developed areas.
2	Lighting Zone 2 pertains to areas with moderate ambient lighting levels. These typically include multifamily residential uses, institutional residential uses, schools, churches, hospitals, hotels/motels, commercial and/or businesses areas with evening activities embedded in predominately residential areas, neighborhood serving recreational and playing fields and/or mixed use development with a predominance of residential uses. Can be used to accommodate a district of outdoor sales or industry in an area otherwise zoned LZ-1.	Recommended default zone for light commercial business districts and high density or mixed use residential districts. Includes neighborhood business districts; churches, schools and neighborhood recreation facilities; and light industrial zoning with modest nighttime uses or lighting requirements.
3	Lighting Zone 3 pertains to areas with moderately high lighting levels. These typically include commercial corridors, high intensity suburban commercial areas, town centers, mixed use areas, industrial uses and shipping and rail yards with high night time activity, high use recreational and playing fields, regional shopping malls, car dealerships, gas stations, and other nighttime active exterior retail areas.	Recommended default zone for large cities’ business districts. Includes business zone districts; commercial mixed use; and heavy industrial and/or manufacturing zone districts.
4	Lighting Zone 4 pertains to areas of very high ambient lighting levels. LZ-4 should only be used for special cases and is not appropriate for most cities. LZ-4 may be used for extremely unusual installations such as high density entertainment districts, and heavy industrial uses.	Not a default zone. Includes high intensity business or industrial zone districts.

APPENDIX G: ANSI/IES RP-8-22, Table 4.2, Recommended Light Trespass Illuminance Limits

Table 4-2. Recommended Maximum Initial Vertical Illuminance Spill Light from Exterior Lighting, Based on Lighting Zone.

Lighting Zone	Maximum Initial Vertical Illuminance, lux (fc)*
LZ-0	0.5 (0.05)
LZ-1	1.0 (0.1)
LZ-2	3.0 (0.3)
LZ-3	8.0 (0.7)
LZ-4	15.0 (1.4)

* Maximum at any point in the vertical plane of the property line.

APPENDIX H: LIGHT TRESPASS ILLUMINANCE CALCULATION DATA

VP-E1

Horizontal (ft)		5	15	25	35	45	55	65	75	85	95	105	115	125	135
Vertical (ft)	85	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	75	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	65	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	55	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	45	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	35	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	25	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	15	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
5	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	

145	155	165	175	185	195	205	215	225	235	245	255	265	275	285	295	305
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

315	325	335	345	355	365	375	385	395	405	415	425	435
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

445	455	465	475	485
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01

VP-E2

Horizontal (ft)		5	15	25	35	45	55	65	75	85	95	105	115	125	135
Vertical (ft)	105	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00
	95	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00
	85	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00
	75	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00
	65	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00
	55	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00
	45	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00
	35	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.00	0.00	0.00
	25	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00
	15	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.00	0.00	0.00
5	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.00	0.00	0.00	

145	155	165	175	185	195	205	215	225	235	245	255	265	275	285	295	305
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.14	0.16	0.17	0.19	0.20
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.19	0.21
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.18	0.19	0.21
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.18	0.20	0.21
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.17	0.18	0.20	0.21
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.17	0.18	0.20	0.22
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.21
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.18	0.19	0.21
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.18	0.19	0.21
0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.10	0.11	0.12	0.13	0.14	0.16	0.17	0.19	0.20
0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.17	0.18	0.20

315	325	335	345	355	365	375	385	395	405	415	425	435	445	455
0.23	0.24	0.26	0.28	0.30	0.32	0.22	0.21	0.20	0.19	0.17	0.16	0.15	0.25	0.26
0.23	0.24	0.27	0.29	0.31	0.34	0.23	0.22	0.20	0.19	0.18	0.17	0.16	0.25	0.27
0.23	0.25	0.27	0.29	0.32	0.34	0.24	0.22	0.21	0.19	0.18	0.17	0.16	0.25	0.27
0.23	0.25	0.27	0.30	0.32	0.34	0.24	0.22	0.21	0.20	0.18	0.17	0.16	0.26	0.27
0.23	0.25	0.28	0.30	0.33	0.35	0.24	0.23	0.21	0.20	0.18	0.17	0.16	0.26	0.27
0.24	0.25	0.27	0.30	0.32	0.34	0.24	0.23	0.21	0.20	0.18	0.17	0.16	0.26	0.27
0.23	0.25	0.28	0.30	0.32	0.35	0.24	0.22	0.21	0.20	0.18	0.17	0.16	0.26	0.27
0.23	0.25	0.27	0.30	0.31	0.34	0.24	0.22	0.21	0.19	0.18	0.17	0.16	0.25	0.27
0.23	0.25	0.27	0.29	0.31	0.33	0.23	0.22	0.20	0.19	0.18	0.17	0.15	0.25	0.27
0.22	0.24	0.26	0.28	0.31	0.33	0.23	0.21	0.20	0.19	0.17	0.16	0.15	0.25	0.26
0.22	0.23	0.25	0.27	0.30	0.31	0.22	0.20	0.19	0.18	0.17	0.15	0.15	0.24	0.25

465 475 485

0.28	0.29	0.31
0.29	0.30	0.31
0.29	0.30	0.32
0.29	0.31	0.32
0.29	0.31	0.32
0.29	0.31	0.33
0.29	0.31	0.33
0.29	0.31	0.32
0.28	0.30	0.31
0.28	0.29	0.31
0.27	0.28	0.30

VP-N1

Horizontal (ft)		5	15	25	35
Vertical (ft)	85	0.28	0.27	0.25	0.24
	75	0.29	0.27	0.26	0.24
	65	0.29	0.27	0.25	0.24
	55	0.29	0.27	0.26	0.24
	45	0.29	0.27	0.26	0.24
	35	0.28	0.27	0.25	0.24
	25	0.28	0.26	0.25	0.24
	15	0.28	0.26	0.25	0.23
	5	0.27	0.26	0.24	0.23

VP-N2

Horizontal (ft)		5	15	25	35	45	55	65	75	85	95	105	115	125	135
Vertical (ft)	205	0.08	0.07	0.06	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03
	195	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03
	185	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04
	175	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04
	165	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04
	155	0.08	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04
	145	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04
	135	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04
	125	0.09	0.08	0.08	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04
	115	0.09	0.09	0.08	0.07	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04
	105	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04
	95	0.10	0.09	0.08	0.07	0.07	0.06	0.07	0.06	0.05	0.05	0.05	0.05	0.04	0.04
	85	0.10	0.09	0.08	0.08	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04
	75	0.09	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04
	65	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04
	55	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.04
45	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	
35	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04	
25	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	
15	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	
5	0.09	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	

	145	155	165	175
0.03	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.03	0.03
0.03	0.04	0.03	0.03	0.03
0.04	0.03	0.03	0.03	0.03
0.04	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.03	0.03
0.04	0.03	0.03	0.03	0.03
0.04	0.04	0.03	0.03	0.03
0.04	0.03	0.03	0.03	0.03
0.04	0.04	0.03	0.03	0.03
0.04	0.04	0.03	0.03	0.03
0.04	0.04	0.03	0.03	0.03
0.04	0.04	0.03	0.03	0.03
0.04	0.04	0.03	0.03	0.03
0.04	0.04	0.04	0.03	0.03
0.04	0.04	0.04	0.03	0.03
0.04	0.03	0.04	0.03	0.03
0.04	0.04	0.03	0.03	0.03
0.04	0.04	0.04	0.03	0.03
0.04	0.04	0.03	0.03	0.03
0.04	0.04	0.04	0.03	0.03

VP-N3

		Horizontal (ft)									
		5	15	25	35	45	55	65	75	85	95
Vertical (ft)	85	0.13	0.15	0.16	0.18	0.20	0.23	0.26	0.30	0.34	0.38
	75	0.13	0.15	0.17	0.19	0.21	0.24	0.27	0.31	0.35	0.41
	65	0.13	0.15	0.17	0.19	0.22	0.24	0.28	0.31	0.36	0.42
	55	0.14	0.15	0.17	0.19	0.22	0.25	0.28	0.32	0.37	0.43
	45	0.13	0.15	0.17	0.19	0.22	0.25	0.28	0.33	0.37	0.43
	35	0.13	0.15	0.17	0.19	0.22	0.25	0.28	0.32	0.37	0.43
	25	0.13	0.15	0.17	0.19	0.21	0.24	0.28	0.32	0.36	0.42
	15	0.13	0.15	0.16	0.19	0.21	0.24	0.27	0.31	0.35	0.40
	5	0.13	0.14	0.16	0.18	0.20	0.23	0.26	0.30	0.33	0.39

VP-N4

		Horizontal (ft)													
		5	15	25	35	45	55	65	75	85	95	105	115	125	135
Vertical (ft)	85	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.26	0.27	0.27
	75	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.27	0.28
	65	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29
	55	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29
	45	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.28
	35	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.28
	25	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.26	0.27	0.28
	15	0.16	0.17	0.17	0.18	0.19	0.20	0.22	0.23	0.23	0.24	0.25	0.26	0.27	0.28
	5	0.16	0.17	0.17	0.19	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.26	0.27

VP-N5

		Horizontal (ft)														
		5	15	25	35	45	55	65	75	85	95	105	115	125	135	
Vertical (ft)	85	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.04
	75	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03
	65	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03
	55	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03
	45	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03
	35	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03
	25	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
	15	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
	5	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

145	155	165	175	185	195
0.05	0.06	0.07	0.08	0.07	0.12
0.05	0.06	0.07	0.08	0.07	0.13
0.04	0.06	0.07	0.07	0.08	0.14
0.04	0.05	0.06	0.07	0.07	0.14
0.04	0.05	0.05	0.06	0.07	0.14
0.04	0.04	0.05	0.06	0.06	0.14
0.03	0.03	0.04	0.05	0.05	0.14
0.03	0.03	0.04	0.04	0.05	0.12
0.01	0.02	0.03	0.03	0.03	0.1

VP-N6

		Horizontal (ft)													
		5	15	25	35	45	55	65	75	85	95	105	115	125	135
Vertical (ft)	85	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04
	75	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04
	65	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04
	55	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.03
	45	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04
	35	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04
	25	0.09	0.08	0.07	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03
	15	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.03	0.04
	5	0.09	0.08	0.07	0.07	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03

145	155	165	175	185
0.03	0.03	0.03	0.03	0.03
0.04	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.03	0.03
0.04	0.03	0.03	0.03	0.03
0.03	0.03	0.03	0.03	0.02
0.03	0.03	0.03	0.03	0.02
0.03	0.03	0.03	0.02	0.02

VP-N7
Horizontal
(ft)

		5	15	25	35	45	55	65	75	85	95	105	115	125	
Vertical (ft)	105	0.13	0.12	0.11	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05
	95	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.06	0.05
	85	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.06	0.05
	75	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.06	0.05
	65	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.06	0.05
	55	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.06	0.05
	45	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05
	35	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05
	25	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05
	15	0.14	0.12	0.11	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.06	0.05	0.05
5	0.13	0.12	0.11	0.10	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.05	0.05	0.05	

	145	155	165	175	185	195	205	215	225
0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03

VP-W1

		5	15	25	35	45	55	65	75	85	95	105	115	125	135
Vertical (ft)	85	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09
	75	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09
	65	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09
	55	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09
	45	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.08	0.08	0.09
	35	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.08	0.08	0.09
	25	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.08	0.08	0.09
	15	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.09
	5	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08

145 155

0.1	0.11
0.1	0.11
0.1	0.11
0.1	0.11
0.1	0.11
0.1	0.11
0.1	0.11
0.1	0.1
0.09	0.1

VP-W2

Horizontal (ft)		5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
Vertical (ft)	205	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07
	195	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07
	185	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08
	175	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08
	165	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08
	155	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.08
	145	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08
	135	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08
	125	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08
	115	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09
	105	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09
	95	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09
	85	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09
	75	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09
	65	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09
	55	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09
45	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09	
35	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	
25	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	
15	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.08	0.09	
5	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.06	0.07	0.07	0.07	0.08	0.08	0.08	

VP-W3

Horizontal (ft)		5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
Vertical (ft)	85	0.27	0.08	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01
	75	0.30	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
	65	0.32	0.10	0.08	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
	55	0.34	0.09	0.08	0.07	0.06	0.06	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.01	0.01
	45	0.33	0.09	0.07	0.07	0.06	0.05	0.05	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01
	35	0.32	0.08	0.07	0.06	0.05	0.05	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01
	25	0.30	0.07	0.05	0.04	0.04	0.03	0.03	0.02	0.01	0.03	0.03	0.02	0.02	0.01	0.01
	15	0.25	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
	5	0.19	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00

VP-W4

		Horizontal (ft)														
		5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
Vertical (ft)	85	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.08	0.09	0.10	0.12	0.15
	75	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.08	0.09	0.11	0.13	0.15
	65	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.16
	55	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.14	0.16
	45	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.14	0.17
	35	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.14	0.16
	25	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.16
	15	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.06	0.08	0.09	0.11	0.13	0.16
	5	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.15

VP-W5

		Horizontal (ft)													
		5	15	25	35	45	55	65	75	85	95	105	115	125	135
Vertical (ft)	85	0.63	0.59	0.55	0.50	0.46	0.42	0.38	0.35	0.32	0.29	0.27	0.24	0.22	0.20
	75	0.67	0.62	0.57	0.52	0.48	0.44	0.40	0.36	0.33	0.30	0.27	0.25	0.22	0.21
	65	0.70	0.64	0.59	0.54	0.49	0.45	0.41	0.37	0.33	0.30	0.27	0.25	0.23	0.21
	55	0.72	0.66	0.60	0.55	0.50	0.46	0.41	0.37	0.34	0.31	0.28	0.25	0.23	0.21
	45	0.73	0.67	0.61	0.55	0.51	0.46	0.41	0.38	0.34	0.31	0.28	0.25	0.23	0.21
	35	0.72	0.67	0.61	0.55	0.51	0.45	0.41	0.38	0.34	0.31	0.28	0.25	0.23	0.21
	25	0.71	0.65	0.60	0.55	0.49	0.45	0.41	0.37	0.34	0.30	0.28	0.25	0.23	0.21
	15	0.69	0.63	0.58	0.53	0.48	0.44	0.40	0.36	0.33	0.30	0.27	0.24	0.22	0.20
	5	0.65	0.60	0.55	0.51	0.46	0.42	0.38	0.35	0.31	0.29	0.26	0.24	0.22	0.20

145	155
0.19	0.17
0.19	0.17
0.19	0.17
0.19	0.18
0.19	0.17
0.19	0.18
0.19	0.17
0.18	0.17
0.18	0.17

VP-W6

		Horizontal (ft)															
		5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	
Vertical (ft)	85	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	
	75	0.10	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	
	65	0.10	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	
	55	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	
	45	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	
	35	0.11	0.09	0.09	0.08	0.07	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03	
	25	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	
	15	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	
	5	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03