

APPENDIX K:
LIGHTING TECHNICAL STUDY

Francis Krahe & Associates
Lighting Technical Study
November 20, 2018.

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LIGHTING TECHNICAL STUDY

November 20, 2018

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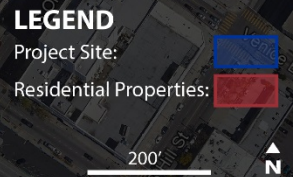
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This Study reviews the parameters that affect Light Trespass or Glare (each as defined below) at sensitive use properties in the vicinity of the Project, reviews the applicable lighting metrics and regulations pertaining to artificial lighting, examines the existing lighting conditions within and surrounding the Project, and evaluates the illuminated signs (Signs) to identify potential environmental impacts on surrounding sensitive use properties.

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. The IESNA 10th Edition Handbook is the current reference published by IESNA, which supersedes the 9th Edition IESNA Handbook and various Recommended Practice (RP) References published by IESNA prior to 2011.

1. Summary

This Study reviews the proposed Project (as described herein as Appendix A) with respect to Light Trespass and Glare at adjacent sensitive use properties near the Project Site. These sensitive use properties are identified as the most sensitive use sites due to their close proximity to the Project and possible direct view of the Project Signs. Light intensity diminishes rapidly in relation to distance (see Inverse Square Law page 9). Therefore, more distant sensitive site locations will receive much lower Light Trespass illuminance and or luminance, and will therefore be less affected by the Project.

Exterior lighting impact issues are focused around two key subjects: Light Trespass and Glare. These two technical terms are defined by the Illuminating Engineering Society of North America (IESNA) as follows:

- **Light Trespass¹** is the light that falls on a property but originates on an adjacent property. 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 the illuminance is measured perpendicular to the source of light, toward the source of light, at the property line, or the location where light is causing an issue, such as a residential window or balcony.
- **Glare²** occurs when either the luminance is too high or the range of brightness in a visual field is too large. A bright light source, such as a flood light or street light, 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 display, in comparison to the surrounding adjacent luminance. The term which describes the extent of Glare at an observer position for a view is referred to as contrast, and is determined by the variation of luminance within the field of view. Contrast is the ratio of peak measured luminance to the average luminance within a field of view. "High," "Medium," and "Low" contrast are terms used to describe these contrast ratios: contrast ratios 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. Any source luminance that is more than 50 times the adjacent background will be viewed as prominent, and may be viewed as distracting.

Light Trespass is evaluated at night. Glare may occur either during the day or night.

This Study analyzes the Project's potential environmental impacts relating to sign illumination. The Project's illuminated signs (Sign Lighting) would be authorized by a Sign District if approved by the City and established by an ordinance pursuant to the provisions of Section 13.11 of the Los Angeles Municipal Code (LAMC). A draft ordinance for the Sign District would be completed as part of the Project entitlements and available before a final City action on the Project. This Lighting Technical Study analyzes the Light Trespass illuminance and Glare from Project Signs within the Sign District in accordance with the assumed sign illumination requirements listed below. The City would consider such illumination requirements as well as the extent of signage on the Project, while creating the Sign District ordinance.

The Project's Sign Lighting is identified and described in Appendix A. The Sign Lighting would ultimately comply with the requirements of the Sign District if adopted by the City, which would regulate sign types, location, size and operating characteristics of signage proposed on the Project Site specifically and within the Sign District boundaries generally. For purposes of impact analysis, this Study analyzes the proposed signage included in the Sign District as a part of the Project (identified in Appendix A as the Conceptual Sign Plan) and types that include, but are not limited to: wall signs, window signs, monument signs, canopy signs, hanging signs, electronic message digital displays, full motion electronic message digital display signs, full motion electronic message digital display projecting signs, supergraphic signs, and building identification signs (Project Signs).

¹ IESNA Handbook, 10th Edition, 19.3: Light Pollution and Trespass, page 19.7

² IESNA Handbook, 10th Edition, 4.10: Glare, page 4.25

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This Study establishes the following illumination requirements for Sign Lighting within the Sign District for purposes of environmental analysis, and if needed, to establish the base permitted illumination requirements in a Sign District Ordinance that the City could approve. Accordingly, the Sign Lighting would comply with the following requirements:

- Light Trespass illuminance from the Project Signs will be less than 3 fc at all sensitive use properties as stipulated by LAMC.
- During daytime, Glare at sensitive use, residential or roadway sites will be less than high contrast conditions with maximum sign luminance of 5000 cd/m².
- At night and during sunset, sunrise, and overcast conditions, Glare at sensitive use, residential or roadway sites will be less than high contrast conditions with a maximum sign luminance of 300 cd/m².
- Sign Lighting will be controlled by a photocell to transition smoothly from the maximum daytime luminance of 5,000 cd/m² to the maximum nighttime luminance of 300 candelas/m², beginning at 45 minutes prior to sunset and completed no later than 20 minutes prior to sunset to avoid potential high contrast, Glare conditions. Similarly, the Project Signs must transition from the night maximum luminance of 300 cd/m² to the day maximum luminance of 5,000 cd/m², beginning no earlier than 20 minutes after sunrise.
- Signs would reduce luminance during times of overcast weather to the required night luminance levels.

This Study demonstrates the Light Trespass from the Project Sign at the adjacent sensitive use properties is below the 3.0 footcandles (fc) maximum threshold as defined by the LAMC. There is no Light Trespass threshold for commercial use properties, which are not considered light or Glare-sensitive receptors. Therefore, at commercial properties where the illuminance is calculated to be above the 3.0 fc threshold there is no Light Trespass impact from the Project Sign(s).

Furthermore, the Project Signs are evaluated with respect to Glare visible at adjacent sensitive use properties or roadways. To present a conservative analysis, this Study evaluates the Project Signs with a maximum luminance of 5000 cd/m² during the day and 300 cd/m² at night with all Project Signs operating at all white.

This Study analyzes the Glare from the Signs at sensitive use properties at night by calculating the contrast ratio, which compares the maximum Sign luminance to the existing average luminance measured at the sensitive use properties. The calculated contrast ratios are less than 30:1, which indicates the Signs will not create a new Glare condition at adjacent sensitive use properties.

The Glare at roadways is evaluated with respect to the standards identified by the California Motor Vehicle Code, which defines maximum sign luminance within drivers' field of view for both day and night. This Study confirms the Project Signs will not exceed the maximum luminance defined by the California Motor Vehicle Code during the day, at night, and during periods of low sun intensity.

Therefore, the results of this Study indicate the Project Signs will not create a new source of Light Trespass or Glare.

2. Project Description

The Project consists of a new mixed-use development (Project) totaling approximately 452,630 square feet of floor area on an approximately 1.73 acre property at 1601 South Hope Street in the South Park District of Downtown Los Angeles (Project Site). The Project is bound by Venice Boulevard to the north, Flower Street to the west, South Hope Street to the east, and Public Facilities zoned parcels and Interstate 10 Freeway to the south.

Project implementation would require the removal of all existing on-site uses, including a parking structure and two low rise commercial use buildings. New development would consist of two buildings, reaching a height of 232 feet and 240 feet respectively, resulting in a floor area ratio of approximately 6:1. The new use would include

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a 300 unit hotel and amenities related to the hotel, 250 residential units and amenities related to the residences, tenant space on the first floor, bike parking, 298 vehicular parking spaces, a plaza at grade, and new Signs.

The Project would provide open space for use by Project residents, hotel guests, employees, and visitors totaling approximately 26,925 square feet. Proposed open space features include at-grade landscaped areas, pedestrian passageways and walkways, and above-grade landscaped terraces and pool decks.

This analysis accurately evaluates the potential for Project Sign Lighting to create a new source of Light Trespass and/or Glare at adjacent sensitive use properties. The Project includes LED signs as described by the Sign Concept Documents (Appendix A). The Project's Sign Lighting complies with the requirements of the City of Los Angeles Municipal Code (LAMC) and the proposed Sign District. The Project Sign locations and sizes are identified in detail within the Sign Concept Plan and are evaluated with all signs operating simultaneously at maximum luminance of 300 cd/m², all white, at night, and 5000 cd/m², all white, during the day. The Project Signs will not operate in this manner in practice. However, this analysis represents a conservative evaluation of the Project Signs potential for offsite Light Trespass illuminance and Glare. Specifically, the proposed Project would conform to the following standards:

- Illuminance (which is measured in footcandles) from the Project Signs would not exceed 3.0 footcandles at any adjacent sensitive use and residentially zoned property line.
- Project Sign luminance (which is measured in candelas per meter squared) would be limited to 5,000 candelas per square meter during the daytime and 300 candelas per square meter in the evening and at night.
- Project Signs would reduce luminance during times of overcast weather to the required night luminance levels.
- Project Signs luminance will transition between daytime and nighttime and between sunny weather and overcast weather at a smooth rate of change over the course of 20 minutes.

This analysis concludes the Project Signs will not create a new source of Light Trespass illuminance and or Glare at sensitive sites.

3. Glossary of Lighting Terminology

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 to facilitate discussion of these issues. 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 TM-15-11</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 calculation for secondary solid angles defined in <i>IES TM-15-11</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.
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.
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. See IESNA 10th Edition Handbook, Section 4.10.1, Discomfort Glare and Section 10.9.2 Calculating Glare. 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).

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

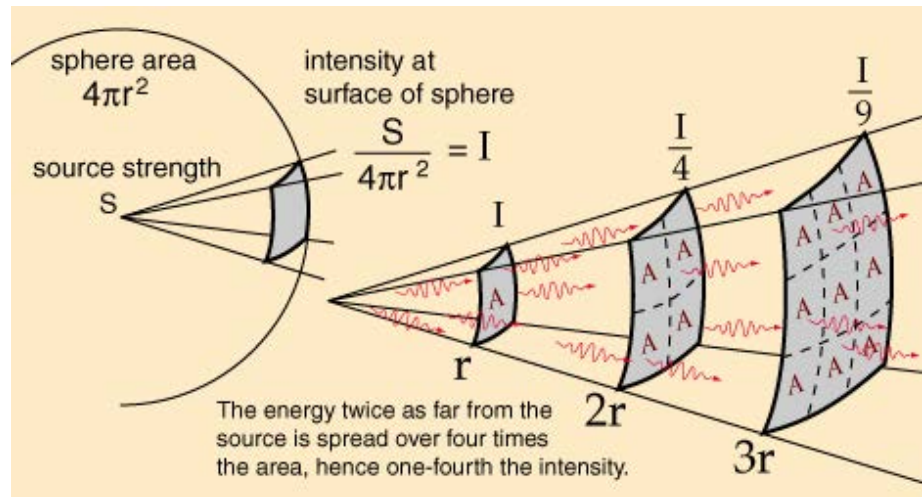


Figure 2: Inverse square law diagram (hyperphysics.phy-astr.gsu.edu)

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.

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 IESNA and summarized in Table 26.4 in the Handbook and adopted by CALGreen.

Lighting Zone LZ2:	Outdoor areas of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting is not uniform or consistent. Lighting is generally desired for safety, security and/or convenience.
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.
Lighting Zone LZ4:	Outdoor areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally desired for safety, security and/or convenience.
Luminaire:	A complete lighting unit consisting of a lamp or lamps and ballast(s) (when applicable) together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps 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) (Candela per square foot) or cd/m^2 (Candela per square meter). $1\text{fL} = 3.43 \text{ cd/m}^2$. 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 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, 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 to the north, south, east and west. Figure 5 below illustrates the Monitoring Site locations.
Skyglow:	Skyglow is the description of luminous atmospheric background and results from both natural and human made conditions. Natural causes of skyglow include sunlight reflected from the surface of the earth and moon, sunlight illuminating the upper atmosphere, and visible illumination from other interplanetary sources. Human made causes of skyglow include electric light that is emitted directly upward into the sky (Uplight), or reflected off of the ground.

4. Review of Lighting Regulations & Reference Standards

Exterior lighting is regulated throughout California by the local municipal code and the state energy and building codes. Pertinent lighting sections are summarized and discussed for the City of Los Angeles, California Municipal Code, the California Vehicle Code, the California Energy Code (CALGreen), the State of California Green Building Code, Reference standards include model lighting ordinances provided by the Illuminating Engineering Society of North America (IESNA) and the International Dark Sky Organization, ASHRAE 90-75, and the U.S. Green Building Council. 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 their property, with minimizing the off-site negative effects of Light Trespass and Glare.

4.1 Los Angeles Municipal Code

The LAMC regulates lighting with respect to light trespass (*i.e.*, the spillover of light onto adjacent light-sensitive properties). The City also enforces the building code requirements of the Los Angeles Building Code, the California Building Code, the California Green Building Standards Code (CALGreen), and the California Electrical Code.

To the extent not superseded by the Sign District Ordinance, regulations applicable to the Project include the 2016 versions of the LAMC and the California Vehicle Code.

The LAMC includes the following sections pertaining to illumination:

- Chapter 1, Article 4.4, Sec. 14.4.4 E: E.: **"Sign Illumination Limitations.** No sign shall be arranged and illuminated in a manner that will produce a light intensity of greater than three foot candles above ambient lighting, as measured at the property line of the nearest residentially zoned property."

In this Study the standards above apply to Sign Lighting where Project Signs are adjacent to sensitive use properties. This Study defines separate Sign Light Trespass illuminance requirements for sensitive use properties within the Sign District.

4.2 Sign District Ordinance

This Study establishes proposed Light Trespass illuminance levels in the Sign District, and specifically on the Project Site, for purposes of environmental impact analysis. The Sign District is intended to specify additional criteria that could apply to Sign illumination. The Sign District would define an additional set of criteria which further regulates Light Trespass illuminance and/or Glare. The regulations contained in the Sign District would be in addition to the LAMC sign regulations. If approved by the City, the Sign District would contain regulations that are different from, more restrictive than or more permissive than the LAMC regulations. In any case, if approved by the City, the regulations in the Sign District would supersede other regulations that could apply within the Sign District.

The following standards that could be used for the Sign District are included below to illustrate limits imposed for daytime and nighttime illumination, regarding refresh rate, illuminance (fc), including luminance (candelas/m²).

- All Signs within this Sign District may be illuminated by either internal or external means.
- All Signs shall be fully dimmable and shall be controlled by a programmable timer and photocell to adjust the Sign luminance according to the time of day and ambient light conditions.
- All Signs shall have a daytime luminance no greater than 5,000 cd/m², and a nighttime luminance no greater than 300 candelas per square meter (cd/m²).
- The Signs shall transition smoothly at a consistent rate from the permitted daytime luminance to the permitted nighttime luminance levels, beginning 45 minutes prior to sunset and concluding 45 minutes after sunset. After sunrise Signs will transition smoothly from the night time maximum luminance of 300 cd/m² for 45 minutes, up to the maximum permitted daytime luminance.

- Any external sign illumination will be directed onto the signage itself and not onto any residential units located outside the Sign District.
- All light emitting diodes used within an Integral Digital Display (as defined in the Sign District) shall have a maximum horizontal beam spread of 165 degrees and a maximum vertical beam spread of 65 degrees. All light emitting diodes shall be oriented down towards the street.

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

Chapter 2, Article 3 of the California Vehicle Code stipulates limits to the location of light sources that may cause Glare and impair the vision of drivers.

ARTICLE 3. Offenses Relating to Traffic Devices [21450 - 21468] (Article 3 enacted by Stats. 1959, Ch. 3.), Section 21466.5 provides that no person shall place or maintain or display, upon or in view of any highway, any light of any color of such brilliance as to impair the vision of drivers upon the highway. A light source shall be considered vision impairing when its brilliance exceeds the values listed below.

The brightness reading of an objectionable light source shall be measured with a 1-1/2 degree photoelectric brightness meter placed at the driver's point of view. The maximum measured brightness of the light source within 10 degrees from the driver's normal field of view 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 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.

In this Study, this code applies to the I-10 Freeway which runs along the south side of the Project, and the City of Los Angeles streets surrounding the Project Site. These roadways have views of the Project Signs as designed in Appendix A.

4.4 California Code of Regulations, Title 24

Title 24 of the California Code of Regulations (CCR), also known as the California Building Standards Code, consists of regulations to control building standards throughout the State. The following components of Title 24 include standards related to lighting: California Green Building Standards Code (Title 24, Part 11)

The California Green Building Standards Code, which is Part 11 of Title 24, is commonly referred to as the CALGreen Code. Paragraph 5.1106.8, Light pollution reduction, requires that all non-residential outdoor lighting must comply with the following:

- The minimum requirements defined below for Lighting Zones 1–4 as defined in Chapter 10 of the California Administrative Code as noted above; and
- Comply with a local ordinance lawfully enacted pursuant to Section 101.7, whichever is more stringent.

4.5 Lighting Zone Designation LZ3

The Project Site at 1601 South Hope Street and surrounding properties within the City of Los Angeles, California 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 night time use adjacent to residences. The California Energy Code (CEC) includes designations for Lighting Zones (LZ) 1 through 4, included below in Appendix C, which correspond to the Light Trespass recommendations within the IESNA 10th Edition Handbook, Table 26.4, included herein Appendix D and E.

All urban areas within California are designated Lighting Zone 3 as default under the CEC, which limits the Light Trespass to 8 lux (0.74 footcandles). Per the CEC, California Building Energy Efficiency Standards, Section 10-114, page 40, 41, the designations for outdoor lighting zones in urban areas are as follows:

"The default for urban areas, as defined by the U.S. Census Bureau, is Lighting Zone 3. Local AHJs (Authorities Having Jurisdiction) may designate areas to Lighting Zone 4 for high intensity nighttime use, such as

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entertainment or commercial districts or areas with special security considerations requiring very high light levels.”

The existing conditions surrounding the Project Site and along South Hope Street and South Flower Street are consistent with the definition of Lighting Zone 3 noted above. In addition, the IESNA defines Lighting Zone 3 as:

“areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience and it is mostly uniform or continuous.”

IESNA Table 26.5, lists a Pre-curfew 8 Lux (0.74 footcandles) maximum at the location where trespass is under review for Zone 3. The CEC standard is well defined and supported by the IESNA and ASHRAE, and other independent lighting organizations such as the International Dark Sky Organization and U.S. Green Building Council.

4.6 IESNA Recommended Practices

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 stipulated 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 for the Project.

The IESNA 10th Edition Lighting Handbook defines Outdoor Lighting Zones relative to a range of human activity versus natural habitat. Table 26.4, Nighttime Outdoor Lighting Zone Definitions, included in Appendix D of this Study, 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 26.4 is referenced by the CEC as noted above in relation to allowable energy use for outdoor lighting. In addition, the IESNA 10th Edition Lighting Handbook defines Recommended Light Trespass Limits in Table 26.5, included in the Appendix E 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 Table 26.5, lists a Pre-curfew 8 Lux (0.74 footcandles) maximum at the location where trespass is under review for Zone 3.

5. 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 Los Angeles uses the Appendix G “questions” as its significance thresholds. The significance threshold 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 significance threshold from Appendix G of the CEQA Guidelines, the City of Los Angeles CEQA Thresholds Guide adds the following criteria for evaluation of the threshold:

- The change in ambient nighttime levels as a result of project sources; and
- The extent to which project lighting would spill off the Property and affect adjacent sensitive use and residential zoned properties.

Specifically, the Project Building Lighting would create a significant impact with regard to artificial light or Glare if, based on the City’s CEQA Thresholds Guide the following criteria are exceeded:

LIGHTING STUDY

- The Project Light Trespass exceeds 3.0 foot-candles at the property line of a sensitive use or residential zoned property and therefore adversely changes the ambient light level at sensitive use or residential properties.
- The Project creates Glare with new high contrast conditions, with luminance greater than 300 cd/m^2 or contrast ratio greater than 30:1, visible from a field of view from a sensitive use or residentially zoned property.

In addition, based on the California Vehicle Code requirements identified above, the Project would create a significant impact with regard to artificial light or Glare effects on drivers of motor vehicles if it exceeded the following additional criteria:

- The maximum measured brightness of the light source within 10 degrees from the driver's normal field of view 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 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.³

6. Methodology

6.1 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, TM-10-00 Addressing Obtrusive Light (Urban Sky Glow and Light Trespass) in Conjunction with Roadway Lighting, and TM-11-00 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 (as defined above). 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, 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 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 Property. Since the Monitoring Sites are located no less than 70 feet away from the Project Site 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 and horizontal 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 Property from that Monitoring Site. The existing conditions luminance data is measured with a

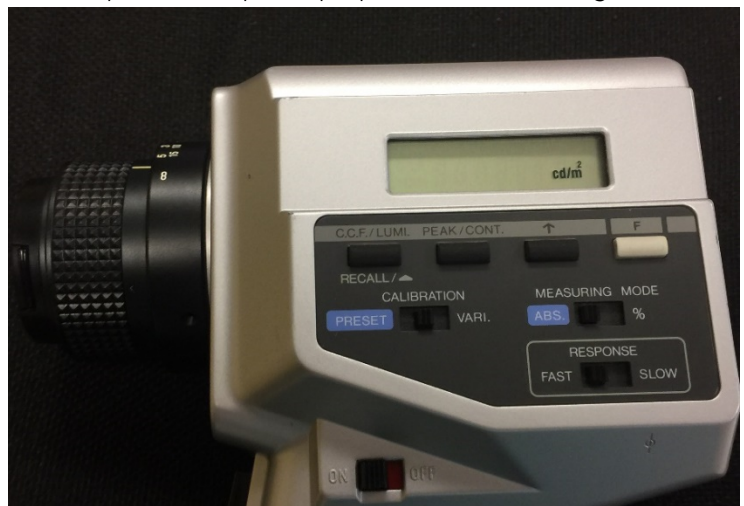


Figure 3: Minolta LS-100 meter

³ The driver's field of view from the center of the roadway plus 10 degrees."

LIGHTING STUDY

Minolta LS-100 Luminance meter with procedures consistent with best practices for field measurement of luminance as per IESNA standards. The LS-100 meter utilized by Francis Krahe & Associates, Inc. reports luminance data in either candelas per square meter or footlamberts (fL). All existing luminance data measured and reported in this Study are recorded as cd/m^2 .

6.2 Project Analysis

The analysis of the Project includes evaluation of the illuminance Light Trespass from the Project at the Property line adjacent to sensitive use properties, and an evaluation of Glare from the Project visible at sensitive use properties or at adjacent roadway locations.

This Study presents a conservative analysis with respect to Light Trespass and Glare. Project Signs are evaluated with a maximum luminance of $300 \text{ cd}/\text{m}^2$ at night, and $5,000 \text{ cd}/\text{m}^2$ during the day, all white light. The actual sign luminance will be defined by the light sources and materials utilized by the Applicant. The Project Signs will generate far lower luminance than the lighting that has been modeled, thus, making this a conservative analysis. This Study evaluates the Sign Concept identified in Appendix A.

a. Project Light Trespass Analysis

Light Trespass illuminance is calculated at the closest sensitive use property lines through the illumination modeling software program AGI32. This software utilizes the 3-dimensional architectural computer model, including Sign dimensions and exterior materials identified in the Sign concept, to generate an accurate prediction of future illuminance. The Light Trespass is evaluated with respect to horizontal and vertical illuminance at the locations where lighting is under review.⁴

To evaluate Light Trespass at the nearest sensitive use properties, the illuminance from the Project is calculated at the review location within a vertical plane at the sensitive use property line, extending from grade to a maximum viewing elevation above grade. The vertical planes extend from grade to 80 feet above grade, the height of the tallest sensitive use building where Light Trespass is under review. The calculated illuminance data is presented at 10 feet on center. The calculation plane simulates the illumination (fc) captured by light meters. Figure 4 illustrates the locations where the lighting is under review and where the vertical illuminance is calculated to evaluate Light Trespass.

The vertical calculation planes analyze the lighting at the nearest sensitive use property line, which will be greater than the illuminance at any location more distant from the Project. Incident light (fc) from a source degrades in proportion to the inverse square of the distance from the source to the location where lighting is under review. The illuminance EV (fc) incident at any given distance D (ft) from an illuminated surface S (ft^2) with uniform surface luminance of L (cd/m^2) is calculated by the following formula:

$$\text{EV} = \frac{L \times S}{10.76 \times D^2}$$

This formula illustrates the reduction in illuminance at any location as the distance increases from a light source. More distant sensitive use properties will receive less light from the Project due to the increased distance. Therefore, the Project Sign Lighting will produce a less significant Light Trespass impact on sensitive use properties more distant from the Project property line

⁴ See Note 2, above.

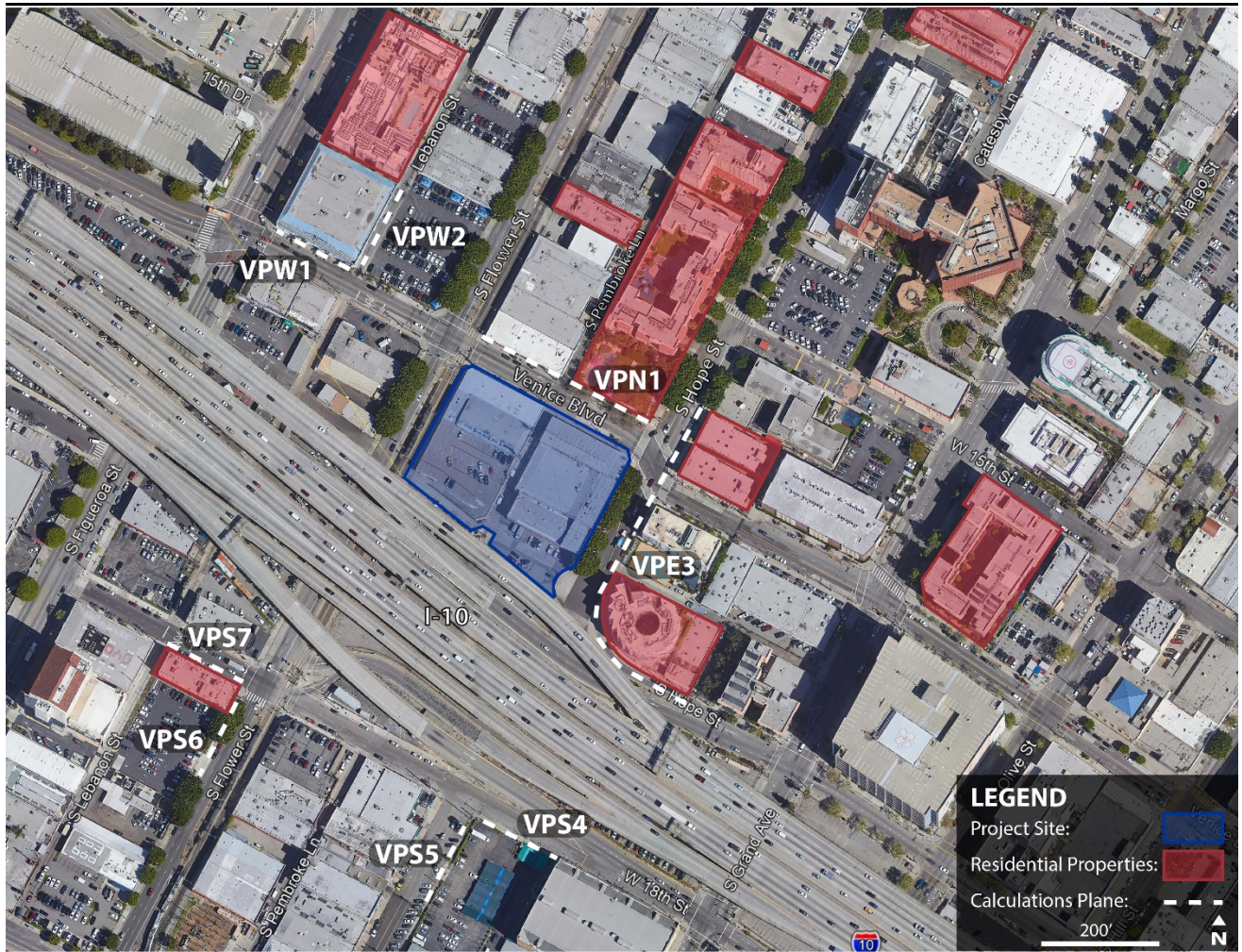


Figure 4: Vertical Calculation Plane Locations

b. Project Glare Analysis

Glare from the Project is evaluated at sensitive night use properties and for drivers on adjacent streets. Project Building Sign luminance is evaluated by the contrast ratio, which equals the maximum Project luminance divided by the measured average existing luminance within the field of view at the Monitoring Sites identified in the field survey of existing conditions (see Section 7 below). Contrast ratios greater than 30:1 are considered potential Glare conditions.

Luminance is independent of distance for large area sources, such as illuminated signs, where the viewing locations are relatively close to the sign and the sign fills a large portion of the field of view. At viewing locations less than 19 times the height or width of the illuminated surface, the sampled area viewed or measured by a luminance meter increases with distance, cancelling the inverse square losses. The standard meter for luminance measurement utilizes a 3 degree lens, thus the 3 degree view translates to approximately 19.1 times the height or width dimension. At viewing locations beyond 19 times the height or width the illuminated surface becomes a point source, and the inverse square relationship will again predict the measured luminance or perceived brightness. The Project includes 11 Signs of different of sizes. The Conceptual Sign Plan includes signs dimensions up to 20 feet high and 60 feet wide, and a range of viewing distances from 70 feet to over 1000 feet. The luminance of the largest signs within the Project are analyzed with a constant luminance of 300 cd/m² for all viewing distances up to 1,000 feet.

LIGHTING STUDY

The potential roadway Glare impacts are analyzed with respect to the Project Sign luminance compliance with the California Vehicle Code requirements for both night and day conditions at the Roadway Receptor Site locations identified in Figure 5 below. According to California Vehicle Code Section 21466.5, the Project 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 exceed 1,000 times the minimum measured brightness in the driver's field of view, except when the minimum values are less than 10 footlamberts (fL).
- At minimum luminance less than 10 footlamberts (fL) the source brightness shall not exceed 500 fL plus 100 times the angle, in degrees, between the driver's line of sight and the light source.

The roadway Glare analysis includes evaluation of the view angle at each freeway receptor Site location from the driver's line of sight to the Project illuminated sign(s) to determine the visibility of the Project illuminated sign(s), and evaluates the luminance of the Project illuminated sign(s) at that location.

7. Project Existing Conditions

The Project consists of a new mixed-use development (Project) totaling approximately 452,630 square feet of floor area on an approximately 1.73 acre property at 1601 South Hope Street in the South Park District of Downtown Los Angeles.

The existing lighting conditions within and surrounding the Project include city street lights, exterior parking lot light, exterior lighting utilized for security and safety, commercial illuminated signs within the Project Site and adjacent buildings, and landscape lighting at adjacent residences.

There are several existing residential use properties adjacent to the Project Site: to the east at the eastern side of South Hope Street; to the northeast of the Project Site at the intersection of South Hope and Venice Boulevard; and to the north on the north side of Venice Boulevard between Hope Street and South Pembroke Lane. Additional more distant residential use properties are located to the south and west of the Project Site.

7.1 Existing Conditions Monitoring Sites

Monitoring sites are utilized to describe and evaluate the existing lighting conditions a and surrounding the Property to determine the maximum potential impacts that may result from light or Glare onto adjacent sensitive sites surrounding the Property. All Monitoring Site locations are within close proximity of the Project and have views of the Property. Monitoring Sites may also be considered existing sensitive use properties, or may be located adjacent to existing sensitive use properties.

The following criteria are used to select potential Monitoring Site locations:

Project Light Visibility – Monitoring sites are 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's location, the Monitoring Site locations and the residential (sensitive use) properties surrounding the Project. The Project is shaded blue. 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 sensitive use sites. These locations are representative of the view to the Project from the vicinity of the sensitive sites surrounding the Project to the north, south, east and west. Figure 5 illustrates the following Monitoring Site locations:

Monitoring Site ME1: Monitoring Site ME1 is located adjacent to the north of I-10 and at the southeast intersection of South Hope Street, to evaluate the Project east facing Sign(s). The

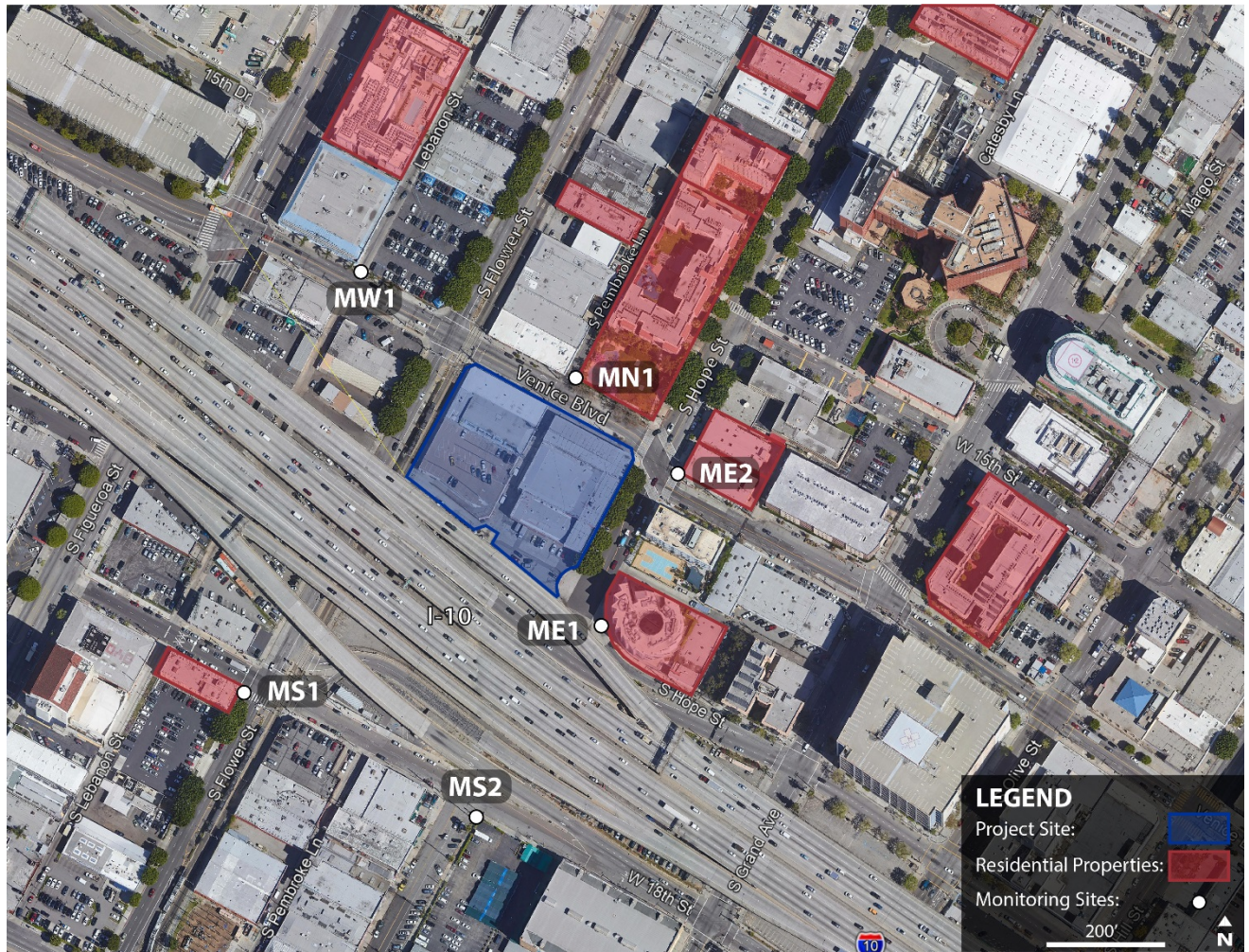


Figure 5: Monitoring Site locations

distance to the Project property line is approximately 93 feet, and the distance to the nearest Project west exterior Sign face is approximately 225 feet.

Monitoring Site ME2: Monitoring Site ME2 is located east of the Project Site and at the northeast intersection of South Hope Street and Venice Boulevard, to evaluate the Project east and north facing Sign(s). The distance to the Project property line is approximately 85 feet, and the distance to the nearest Project west exterior Sign face is approximately 92 feet.

Monitoring Site MN1: Monitoring Site MN1 is located across Venice Boulevard to the north of the Project Site at the corner of Venice Boulevard and South Pembroke Lane, to evaluate the Project north facing Sign(s). The distance to the Project property line is approximately 65 feet, and the distance to the nearest Project Sign face is approximately 70 feet.

Monitoring Site MS1: Monitoring Site MS1 is located south of I-10 (directly adjacent to West 18th Street to the south) and at the southwest intersection of South Flower Street and West 18th Street, to evaluate the Project south facing Sign(s). The distance to the Project property line is approximately 475 feet, and the distance to the Project south exterior Sign face is approximately 495 feet.

Monitoring Site MS2: Monitoring Site MS2 is located south of I-10 and at the southeast intersection of South Hope Street and West 18th Street, to evaluate the Project south facing Sign(s). The

distance to the Project property line is approximately 408 feet, and the distance to the Project south exterior Sign(s) face is approximately 500 feet.

Monitoring Site MW1: Monitoring Site MW1 is located at the northwest corner of Venice Boulevard and Lebanon Street, to evaluate the Project east facing Sign(s). The distance to the Project property line is approximately 254 feet, and the distance to the Project west exterior Sign face is approximately 430 feet.

7.2 Criteria

As established in Section 1.3, 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	Horizontal and vertical illuminance measurements at each Monitoring Site with Minolta illuminance meter.
Glare – Contrast Ratio	Observed existing conditions	Measured luminance of light sources, lighted surfaces, and illuminated signs visible from the Monitoring Site within the field of view to the Project Site.

7.3 Monitoring Site Survey Data

The observations and measurement of existing lighting conditions within and surrounding the Property are summarized below in relation to the evaluation factors established in Section 5, Significance Threshold:

Illuminance: The Measured Illuminance listed in Table 2, below, summarizes the measured existing Illuminance at the Monitoring Sites, and defines the existing lighting conditions at the sensitive Receptor Sites in the vicinity of the Project Site.

Illuminance less than 1.0 fc is evaluated as “low illuminance”; 1.0 fc to 2.0 fc is evaluated as “medium illuminance”; 2.0 fc to 3.0 fc is evaluated as “high illuminance”; greater than 3.0 fc is considered “very high illuminance”.

The measured illuminance within Table 2 is consistent with an urban lighting condition. The range of measured illuminance includes medium to high illuminance at the street and sidewalk within the public right of way and nearby commercial properties, to low illuminance adjacent to and within residential properties. There is sufficient light for safety and security.

The existing Property includes lighting for the existing buildings, parking lot and signs. Adjacent commercial properties to the north, east, and west contribute to a relatively bright night environment.

The highest existing horizontal illuminance level was recorded at Monitoring Site at MS2 with 2.35 fc, while the lowest horizontal illuminance was recorded at Monitoring Site MN1 at 0.12 fc. The highest existing vertical illuminance level was recorded at Monitoring Site ME2 at 1.76 fc, while the lowest vertical illuminance was recorded at Monitoring Site ME1 at 0.19 fc.

LIGHTING STUDY

Table 2. Measured Illuminance (fc) at Monitoring Sites

Monitoring Site	Illuminance (fc)		Description	Evaluation
	Horizontal	Vertical		
ME1	0.28	0.19	Measured 5 ft above grade in the east side sidewalk as South Hope street turns parallel to the I-10 Freeway.	Low horizontal and vertical illuminance
ME2	1.56	1.76	Measured 5 ft above grade in the sidewalk at the northeast corner of S Hope St. and Venice Blvd.	Medium horizontal and vertical illuminance
MN1	0.12	0.31	Measured 5 ft above grade in the sidewalk at the northeast corner of Venice Blvd. and S. Pembroke Ln.	Low horizontal and vertical illuminance
MS1	1.03	1.64	Measured 5 ft above grade in the sidewalk at the southwest corner of S. Flower St. and W. 18 th St.	Medium horizontal and vertical illuminance
MS2	2.35	0.51	Measured 5 ft above grade in the sidewalk at the corner of S. Hope St. and W. 18 th St.	High horizontal illuminance, low vertical illuminance
MW1	0.43	0.57	Measured 5 ft above grade at the northeast corner of Venice Blvd. and Lebanon St.	Low horizontal and vertical illuminance

Contrast/Glare: 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 highest Measured Luminance as compared to the 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 peak measured 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 indicates a potential Glare condition.

Table 3 summarizes the field measurements and observations of the existing Glare conditions at the Monitoring Sites surrounding the Project Site, including any obstructions that limit the visibility of the Project Site within the field of view from the Monitoring Site. Field measurement data is presented for each Monitoring Site in Table 3 including the Maximum Measured Luminance, the calculated Average Measured Luminance, and the calculated Contrast Ratio comparing the Maximum Luminance to Average Luminance. Table 3 also describes the existing conditions visible in the field of view to the Project Site from the Monitoring Site, including any obstructions, the most prominent visible light sources, and the minimum measured luminance for the surrounding illuminated surfaces. The maximum luminance measured includes prominent, high brightness light sources and illuminated surfaces, such as street lights, existing 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 an industrial site with parking lot light poles and existing exterior lights. The Project Site is well illuminated with many bright surfaces visible.

LIGHTING STUDY

Table 3: Measured Luminance, (cd/m²) at Monitoring Sites

Monitoring Site	Luminance (cd/m ²)		Contrast Ratio (Max / Average)	Description	Evaluation
	Avg.	Max.			
ME1	109.2	2357.0	21.6	Maximum luminance measured at street light located at Project Site opposite ME1 (2357.0 cd/m ²), sign pylon in distance (37.0 cd/m ²). Other measured luminance below 1.0 cd/m ²	Medium contrast ratio
ME2	64.7	1141.0	17.6	Maximum luminance measured at street light at corner of Project site (1141 cd/m ²), traffic signal light (109.0 cd/m ²), sign pylon (275.0 cd/m ²).	Medium contrast ratio
MN1	59.1	607.7	10.3	Maximum luminance measured at street light (607.7 cd/m ²), lighting from within the existing building on the Project Site (4.3 cd/m ²), Project Site alley (365.0 cd/m ²).	Medium contrast ratio
MS1	94.3	1374.0	14.6	Maximum luminance measured at street light at intersection of W. 18 th St. & S. Flower St. (1374.0 cd/m ²), traffic signal light (675 cd/m ²). Other measured luminance varies from 0.5 cd/m ² to 5.9 cd/m ² .	Medium contrast ratio
MS2	54.8	1187.0	21.7	Maximum luminance measured at I-10 freeway light (1187.0cd/m ²), high-rise façade lighting (4.3 cd/m ²). Other measured luminance varies from 0.5 cd/m ² to 1.1 cd/m ² .	Medium contrast ratio
MW1	56.0	957.0	17.1	Maximum luminance measured at street light at the intersection of Venice Blvd. & S. Flower St. (957.0 cd/m ²) and traffic signal light (251.8 cd/m ²). Other measured luminance varies from 0.14 cd/m ² to 9.0 cd/m ²	Medium contrast ratio

LIGHTING STUDY

a. Monitoring Site ME1:

Monitoring Site ME1 is located to the east of the Project Site, north of the I-10 Freeway at the east side of South Hope Street right of way at the corner where South Hope Street turns 90 degrees. The view toward the Project Site includes street lights along South Hope Street, parking lot lights and industrial lighting within the Project Site, and an illuminated sign pylon to the west of the Project Site. Roadway lighting for the I-10 Freeway and exterior lighting for the commercial and residential properties in the vicinity of the Project are visible in the distance and create visible skyglow. The street light directly across the street from the monitoring site is the most dominant source of light followed by the pylon sign visible in the distance. The smaller sign face of the south facing freeway sign is visible from the monitoring site. There is an oblique view of the sign facing South Hope Street.



Figure 6: ME1 July 3, 2018, 12:28 P.M.



Figure 7: ME1 June 21, 2018, 9:26 P.M.

b. Monitoring Site ME2:

Monitoring Site ME2 is located to the east of the Project Site, at the intersection of South Hope Street and Venice Boulevard. The view toward the Project Site includes street lights along South Hope Street and Venice Boulevard, exterior lighting at the Project Site, and the I-10 Freeway at the south boundary of the Project Site. Illuminated signage along Venice Boulevard is visible in the distance. The Project Sign facing South Hope Street would be visible directly across the intersection of South Hope Street and Venice Boulevard. There is an oblique view of the signs facing Venice Boulevard.



Figure 8: ME2 October 26, 2018, 3:03 P.M.



Figure 9: ME2 November 1, 2018, 9:56 P.M.

c. Monitoring Site MN1:

Monitoring Site MN1 is located north of the Project Site at the north boundary of the Venice Boulevard right of way, midway between South Flower Street and South Hope Street. The view toward the Project Site includes street lights along Venice Boulevard, exterior lighting at the Project Site, and lighting from within the existing building on the Project Site. Project Signs facing north on Venice Boulevard are visible directly across Venice Boulevard from the monitoring site. There views of the Project Signs that exist on the interior paseo of the Project Site.



Figure 10: MN1 October 26, 2018, 3:05 P.M.



Figure 11: MN1 November 1, 2018, 9:59 P.M.

d. Monitoring Site MS1:

Monitoring Site MS1 is located south of the Project Site, south of I-10 Freeway (directly adjacent to West 18th Street to the south) and at the southwest intersection of South Flower Street and West 18th Street. The view toward the Project Site includes street lights along South Flower Street, and parking lot. Street lights within the I-10 Freeway to the south of the Project are visible in the distance and create skyglow brightness. The most significant light sources are the street lighting and lights at the intersection of South Flower Street and West 18th Street. There is an obscured, oblique view of the west facing sign along South Flower Street. The south facing freeway sign may be visible from higher elevations.



Figure 12: MS1 July 3, 2018, 12:34 P.M.



Figure 13: MS1 June 21, 2018, 9:05 P.M.

e. Monitoring Site MS2:

Monitoring Site MS2 is located south of the Project Site and south of I-10 Freeway at the southeast intersection of South Hope Street and West 18th Street. The view toward the Project Site includes street lights along West 18th Street and the I-10 Freeway at the south boundary of the Project Site. Exterior street lights within the I-10 Freeway to the south of the Project are visible in the distance and create skyglow brightness. High-rise building façade lighting is also visible in the distance and contributes to skyglow brightness. The most dominant source of light is from visible from Monitoring site MS2 is the lighting along the I-10 Freeway. There are no signs visible from the monitoring site. There may be a view of the south facing freeway sign from higher elevations.



Figure 14: MS2 July 3, 2018, 12:38 P.M.

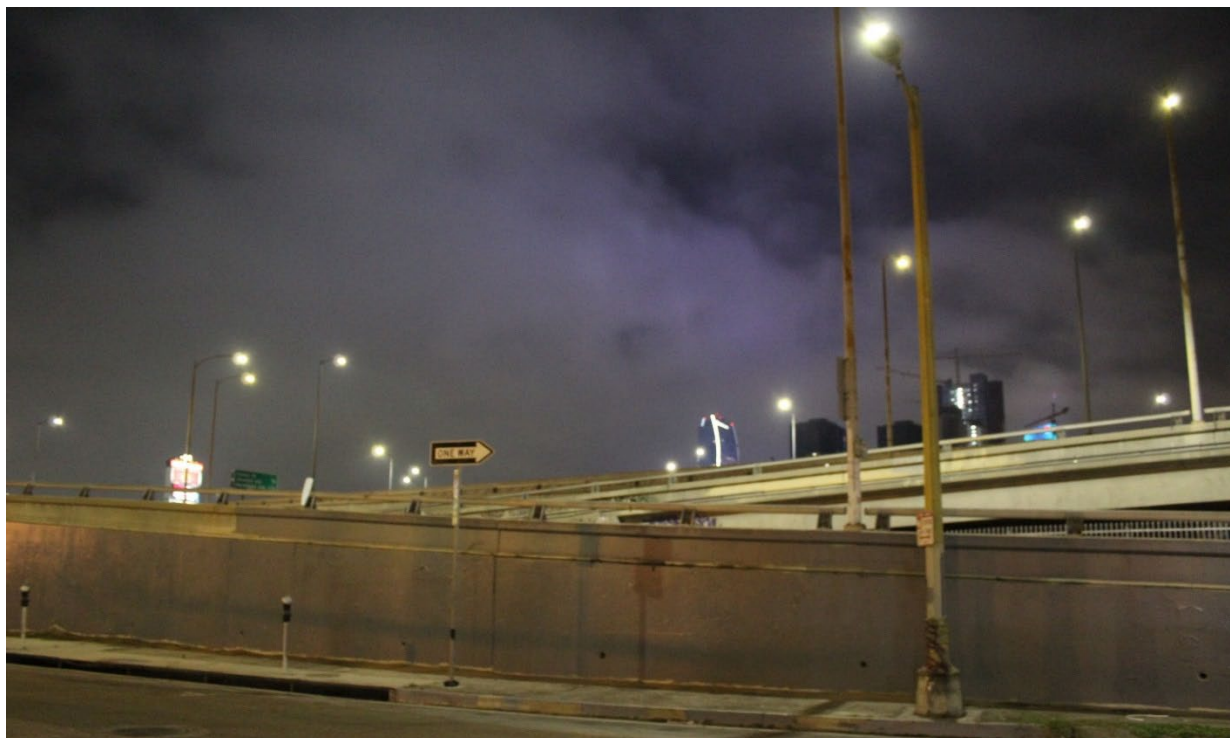


Figure 15: MS2 June 21, 2018, 9:17 P.M.

f. Monitoring Site MW1:

Monitoring Site MW1 is located west of the Project Site at the northwest corner of Venice Boulevard and Lebanon Street. The view toward the Project Site includes street lights along Venice Boulevard, parking lot lights and the industrial lighting within the Project Site. The car sales lot to the directly to the north of the monitoring site creates high ambient illuminance. There is a slightly obscured view of the west facing Project Sign along South Flower Street. There is an oblique view of the north facing signs along Venice Boulevard.



Figure 16: MW1 July 3, 2018, 12:30 P.M.



Figure 17: MW1 June 21, 2018, 8:54 P.M.

8. The Project Analysis

The Project would introduce new Signs as described in Section 2 and depicted in Appendix A. Future proposed Project may cause Light Trespass or Glare with respect to the following variables:

- The Project Sign or light source projects light toward an adjacent property, and is close enough (immediately adjacent to or less than 1000 feet away) to create substantial Light Trespass illuminance at a sensitive use property line.
- The light source surface area is large enough to create substantial Light Trespass illuminance at an adjacent sensitive use property line.
- The light source surface is bright enough to create Glare, or high contrast conditions, when the Sign surface luminance is compared to the surrounding surface luminance.

The following additional criteria are used to evaluate the Light Trespass and Glare impacts of the Project:

- Light Trespass illuminance must be less than 3.0 fc at adjacent sensitive use and residential zoned property lines.
- Sign Luminance visible from sensitive use and residential properties creates high contrast conditions, greater than 300 cd/m² and greater than 30 to 1 contrast ratios.

8.1 Project Sign Light Trespass Illuminance Analysis

The Project Sign Light Trespass analysis evaluates the illuminance (fc) at the nearest adjacent residential property line with respect to light leaving the Project toward adjacent properties from the Project Signs. The Project Signs include the signs as defined in and as illustrated in the Project Concept Sign Plan in Appendix A.

As summarized in Table 4, the Project Sign Light Trespass illuminance at the Vertical Planes varies from a minimum of 0.01 fc to a maximum of 2.84 fc. The results of this analysis conclude that there would not be significant light trespass at nearby sensitive use sites. Complete calculated data is presented in Appendix E

Sign Light Trespass illuminance calculation data is presented below in rendered views within Figures 18 and 19. The calculated data is presented as a grid on the Vertical Plane surface to the east, south, west and north of the Project Site. The locations where the Sign Light Trespass Illuminance data is equal to or greater than 3.0 fc are shown in red text. Locations where the illuminance data is less than 3.0 fc are shown as white text.

Figures 18 and below show the Project Site and all calculation planes. All calculation plane data is below the threshold, and therefore appears as white points in the renderings.

The maximum Light Trespass at any of the Vertical Planes is 2.84 fc, which is less than the 3.0 fc maximum illuminance threshold established above. All of the vertical calculation planes adjacent to the property line of the sensitive use or residential zoned properties in the vicinity of the Project Site.

Table 4: Sign Illuminance (fc) – Calculated at vertical planes where lighting is under review

Vertical Plane	Description	Illuminance (fc)			Analysis
		Vertical			
		Max	Min	Average	
VPW1	Northwest of the Project Site along Venice Boulevard	0.14	0.04	.08	Below threshold of 3 fc, Not an impact
VPW2	Northwest of the Project Site along Lebanon Street	0.27	0.11	0.18	Below threshold of 3 fc, Not an impact
VPE3	East Adjacent Project Property Line along South Hope Street	1.35	0.01	0.40	Below threshold of 3 fc, Not an impact
VPN1	North of the Project Site along Venice Boulevard	2.84	0.19	1.11	Below threshold of 3 fc, Not an impact
VPS4	Southeast of the Project Site along West 18 th Street	0.30	0.16	0.22	Below threshold of 3 fc, Not an impact
VPS5	Southeast of the Project Site along South Hope Street	0.16	0.08	0.12	Below threshold of 3 fc, Not an impact
VPS6	Southwest of the Project Site along South Flower Street	0.16	0.07	0.11	Below threshold of 3 fc, Not an impact
VPS7	Southwest of the Project Site along West 18 th Streer	0.37	0.23	0.30	Below threshold of 3 fc, Not an impact

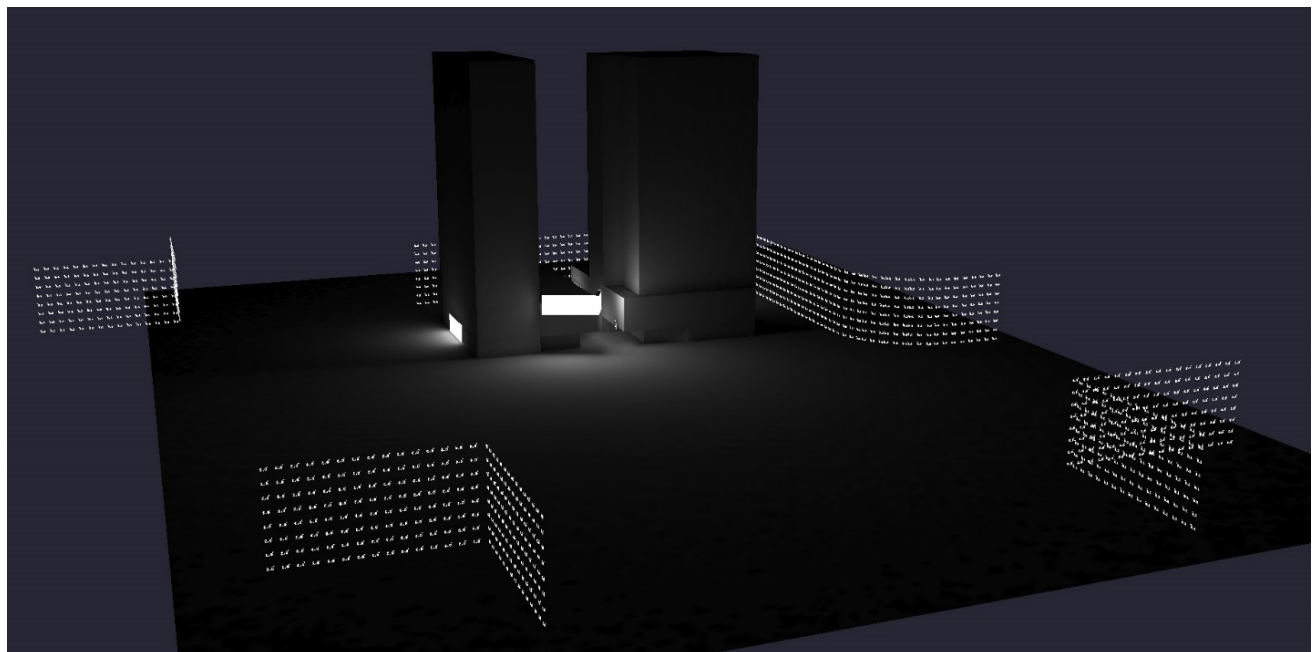


Figure 18: North view sign illuminance data (fc) rendered

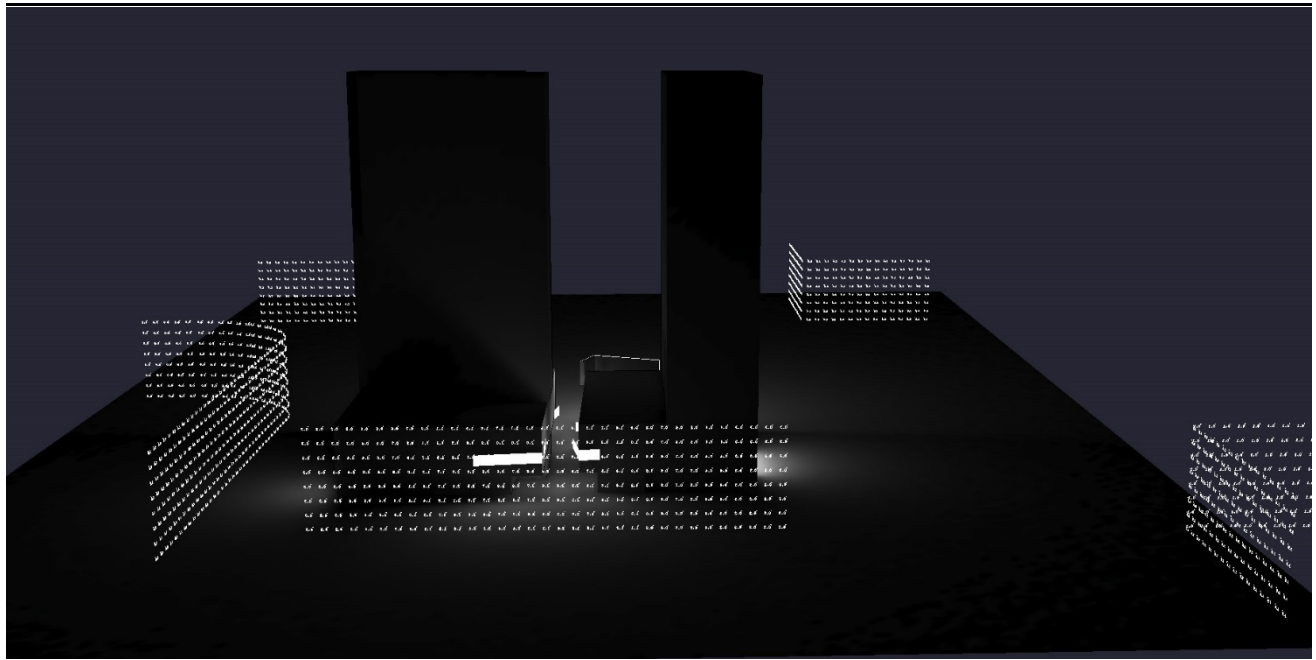


Figure 19: South view sign illuminance data (fc) rendered

8.2 Project Sign Glare Analysis

Glare from Sign lighting occurs when the light source is visible against a dark background, such as a dark sky. The maximum source brightness is determined by the rated source luminance. For this Study, the maximum night time sign luminance is 300 cd/m². The existing conditions surrounding the Project at the Monitoring Sites summarized by the Measured Luminance presented in Table 3 in Section 6 above. Table 5 summarizes the Contrast Ratio calculated for the Sign maximum night luminance (300 cd/m²) versus the average existing Measured Luminance in Table 3.

Table 5: Contrast Ratio: comparison of Measured Luminance to Project Sign(s) @ 300 cd/m²

Monitoring Site	Measured Luminance (cd/m ²)		Project Sign Luminance (cd/m ²)	Contrast Ratio (Sign / Measured Average)	Analysis
	Average	Maximum			
ME1	109	2357	300	2.7	Low Contrast Ratio, no impact
ME2	65	1141	300	4.6	Low Contrast Ratio, no impact
MN1	59	608	300	5.1	Low Contrast Ratio, no impact
MS1	94	1374	300	3.2	Low Contrast Ratio, no impact
MS2	55	1187	300	5.5	Low Contrast Ratio, no impact
MW1	56	957	300	5.4	Low Contrast Ratio, no impact

LIGHTING STUDY

The results of this comparison of the Project Sign luminance at 300 cd/m² to the existing Measured Luminance indicates the Contrast Ratios at all Monitoring Sites are less than 10 to 1. Contrast Ratios less than 10 to 1 are a low contrast condition. Since the contrast ratio at all Monitoring Sites is significantly less than 30 to 1 (highest ratio is 5.5 to 1) the Project Signs will not create a Glare condition at all Monitoring Sites. The calculated Contrast Ratio presented and evaluated in Table 5 indicates the Project Signs will not create a source of high contrast or Glare visible from adjacent sensitive use properties.

8.3 Project Sign Glare Analysis for Roadways

The lighting impact to driver's visibility from the Project Sign(s) is evaluated by way of the methodology defined above at the locations where lighting is under review. As summarized below, the results of this evaluation demonstrate the light impacts resulting from the Project Signs at the locations where light is under review are below the significance threshold for excessive luminance, or Glare, during night, twilight (sunrise/sunset), and day. The Project meets the California Vehicle Code standard for roadways approaching the Project from all directions.

The Glare analysis of the Project Signs during night assumes the simultaneous use of all Project illuminated signs on full white at the maximum luminance allowed by the SPA, and compares the resulting luminance to the most stringent requirements of the California Vehicle Code to determine if the Project Signs introduce a source of distracting Glare to drivers. 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 evaluates Project Signs against a threshold for luminance of a maximum 500 fL.

A measured brightness within the driver's field of view of less than 10 fL may occur at night. The Project Sign(s) are evaluated with a maximum luminance of 300 cd/m². Calculating the equivalent Project sign luminance by converting to english units from metric units: 300 cd/m² equals 87.6 fL. The Project signs will not exceed 87.6 fL, which is 82% less than 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.

For 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, signs 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). All Project illuminated signs will operate at maximum of 87.6 fL at night, or less than approximately 9% of the maximum allowed by the California Vehicle code for those locations at 15 degrees from the center of the driver's field of view. Therefore, at night the Project illuminated signs 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.

The Project illuminated signs are also evaluated during twilight (the transition period from day to night, from 45 minutes before sunset to 20 minutes before sunset, and from 20 minutes after sunrise to 45 minutes thereafter). 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 luminance occurs at sunset or 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 20 minutes prior to sunset and 20 minutes after sunrise, extending the duration of night. At 20 minutes prior to sunset the ambient sunlight will be greater than the minimum values at sunset, and at 20 minutes after sunrise the luminance will be greater than the minimum at sunrise. At 20 minutes prior to sunset, 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 20 minutes prior to sunset until 20 minutes after sunrise. Therefore, the maximum luminance threshold during this time will remain at 500 fL as noted above

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in the evaluation of the night threshold. The maximum sign luminance of 500 fL converting to metric units equals 1579 cd/m².

The Project Signs are designed to comply with the Sign District Ordinance which requires that the Project illuminated signs operate at less than 300 cd/m² (87.6 fL) maximum luminance, from 20 minutes before sunset to 20 minutes after sunrise. At 45 minutes prior to sunset the Project Signs are specified to begin transition from the maximum daytime luminance of 5,000 cd/m² to the maximum nighttime luminance of 300 cd/m². This transition must be completed no later than 20 minutes prior to sunset to avoid potential high contrast, Glare conditions. Similarly, the Sign District indicates the Project Signs are specified to transition from the night maximum luminance of 300 cd/m² to the day maximum luminance of 6,000 cd/m², beginning no earlier than 20 minutes after sunrise.

Therefore, the Project Signs will not exceed 300 cd/m² for the period beginning 20 minutes prior to sunset until 20 minutes after sunrise. The Sign District requires that the Project illuminated signs remain limited to the 300 cd/m² (87.6 fL) maximum luminance value, from 20 minutes before sunset to 20 minutes after sunrise. Therefore, at 20 minutes before and including sunset and at sunrise and 20 minutes after, the Project illuminated signs will not exceed the threshold of 500 fL, and will therefore not introduce a new source of Glare.

The evaluation of the Project illuminated signs during the day (20 minutes after sunrise until 20 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 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 (20 minutes after sunrise until 20 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. The Sign District requires that the Project illuminated sign(s) not exceed 5,000 cd/m² (1,606 fL) during the daytime hours of operation, and Project sign(s) will therefore operate at less than 20% of the maximum luminance stipulated by the California Vehicle Code. Therefore, the Project illuminated 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 Sign District requires that the Project illuminated signs include an electronic control system to reduce the sign luminance from 5,000 cd/m² (1,606 fL) to 300 candelas/m² (87.6 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 illuminated signs will transition from the daytime 5,000 cd/m² (1,606 fL) to 300 candelas/m² (87.6 fL) maximum, and thereby ensure that the sign brightness remains less than the maximum brightness stipulated by the California Vehicle Code. Therefore, the Project illuminated signs will not create a new source of Glare during day time periods with storm or severe overcast weather conditions.

The Project illuminated signs are designed to not exceed 300 candelas/m² (87.6 fL) luminance at night or during overcast sky conditions, and will not exceed 5,000 cd/m² (1,606 fL) during the day. These values are less than the California Vehicle Code standard, including 20% of the maximum allowable luminance identified as the threshold for Glare during the day, therefore the Project illuminated signs will not create a new source of Glare.

9. Conclusions

This analysis accurately evaluates the potential for Project Sign Lighting to create a new source of Light Trespass and/or Glare at adjacent sensitive use properties (Monitoring Sites). The Project includes LED signs as described by the Sign Concept Documents (Appendix A). The Project's Sign Lighting complies with the requirements of the City of Los Angeles Municipal Code and the proposed Sign District. The Project Sign locations and sizes are identified in detail within the Sign Concept Plan and are evaluated with all signs operating simultaneously

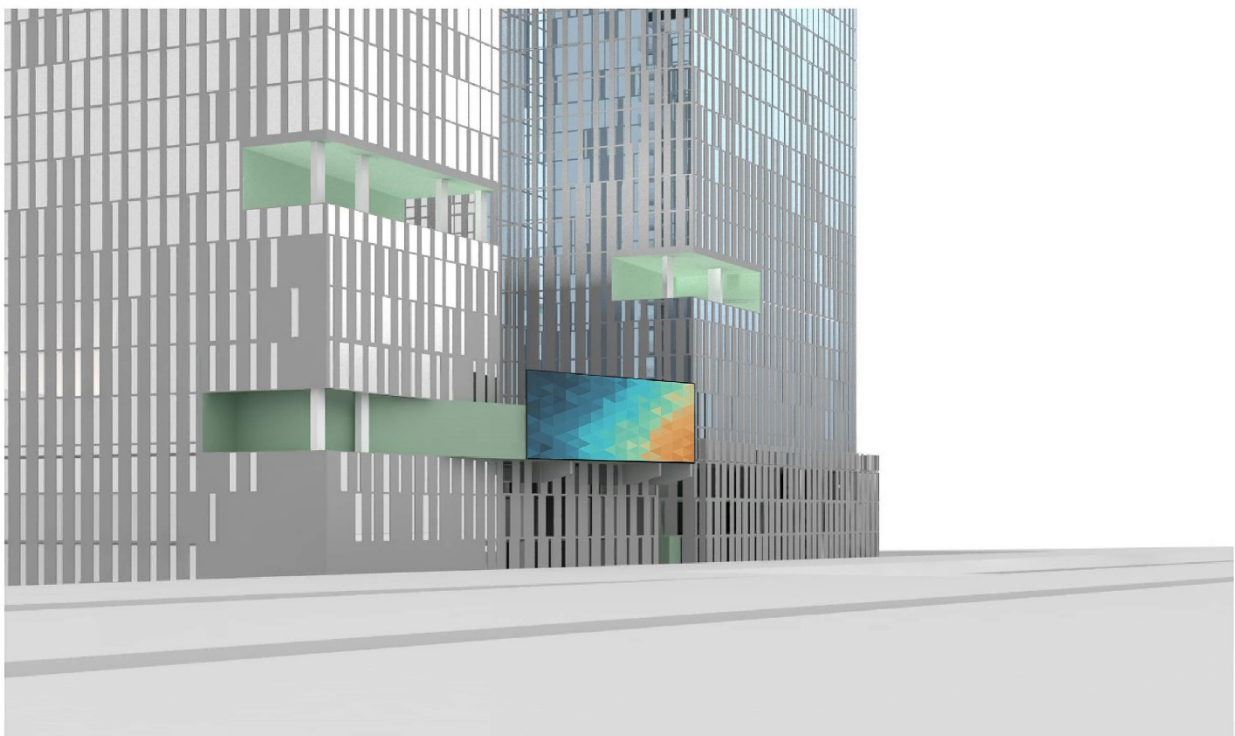
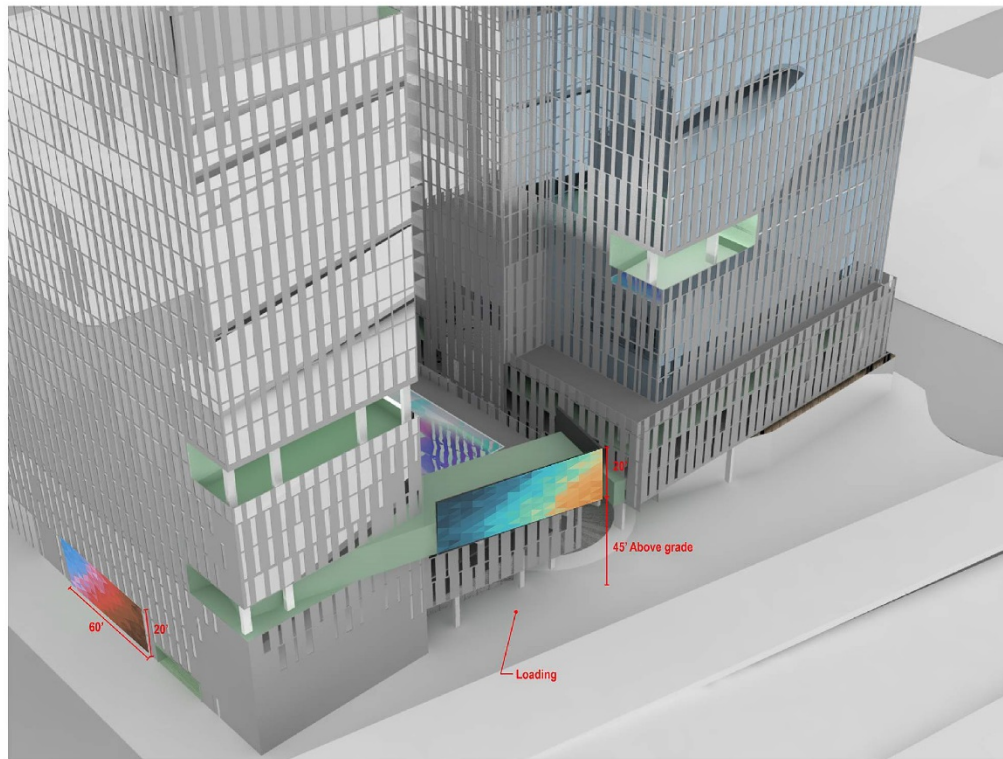
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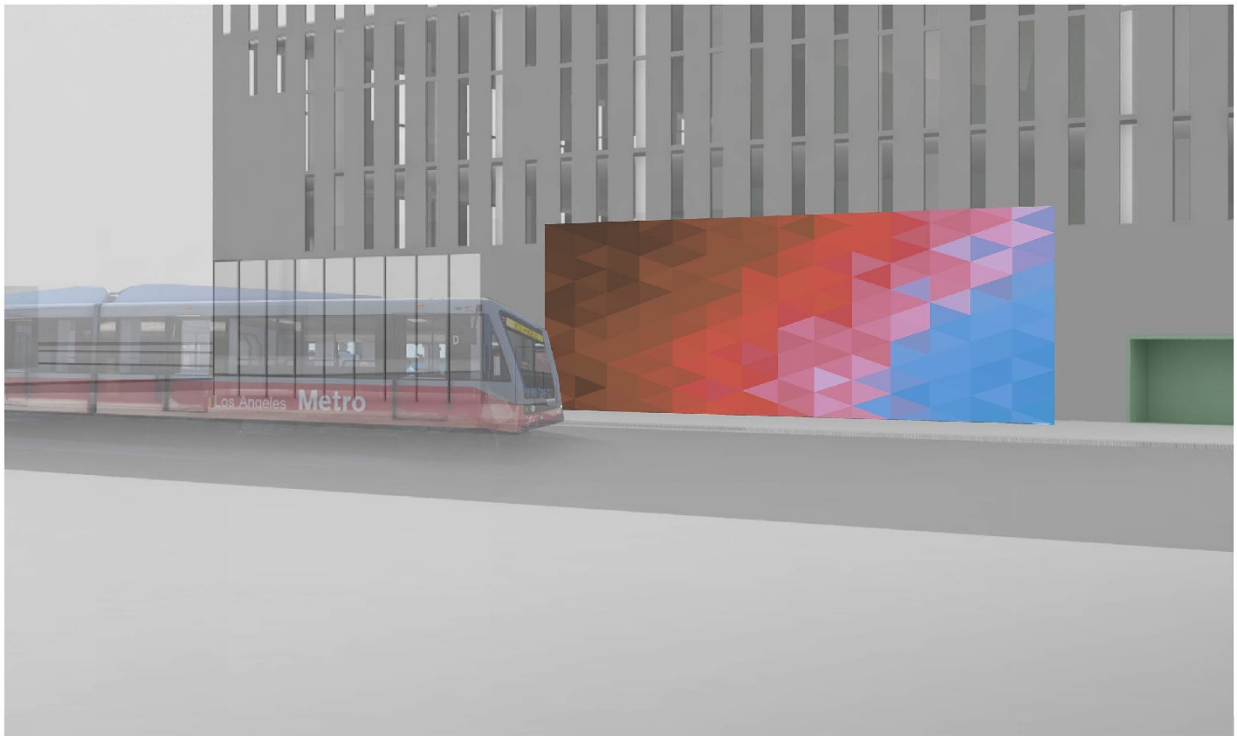
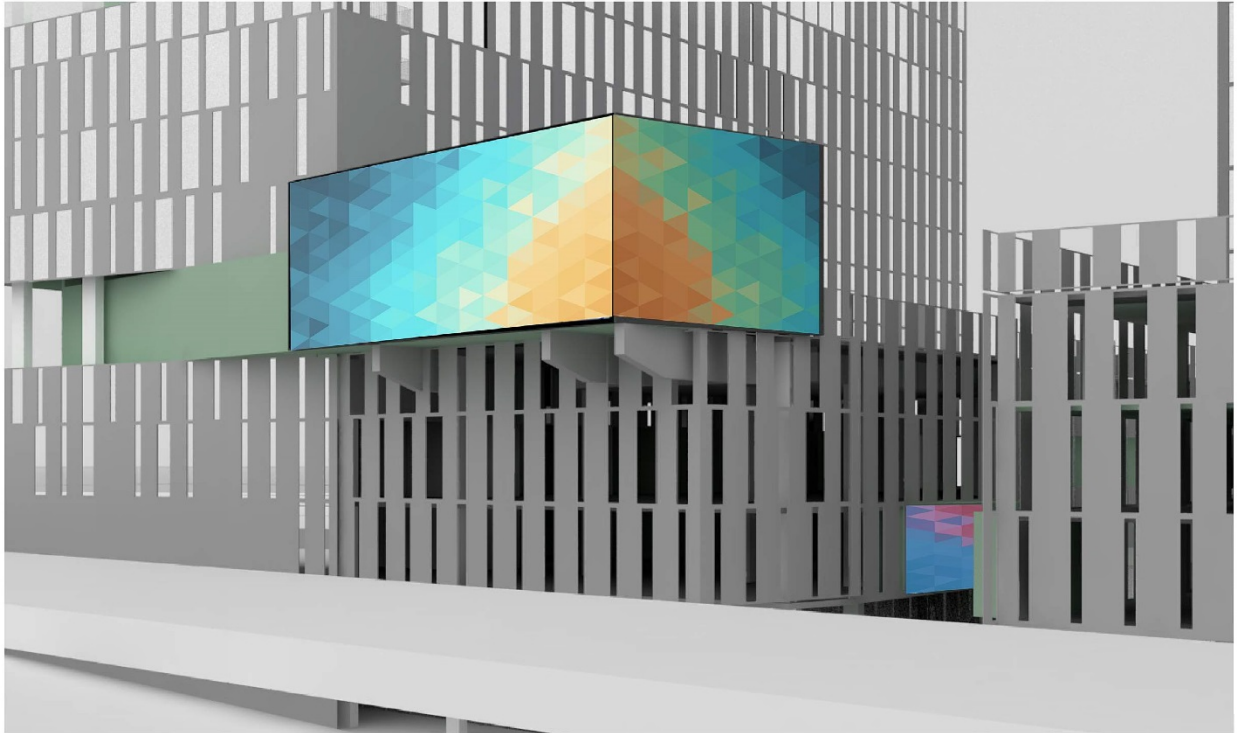
at maximum luminance of 300 cd/m², all white, at night, and 5000 cd/m², all white, during the day. The Project Signs will not operate in this manner in practice. However, this analysis represents a conservative evaluation of the Project Signs potential for offsite Light Trespass Illuminance and Glare.

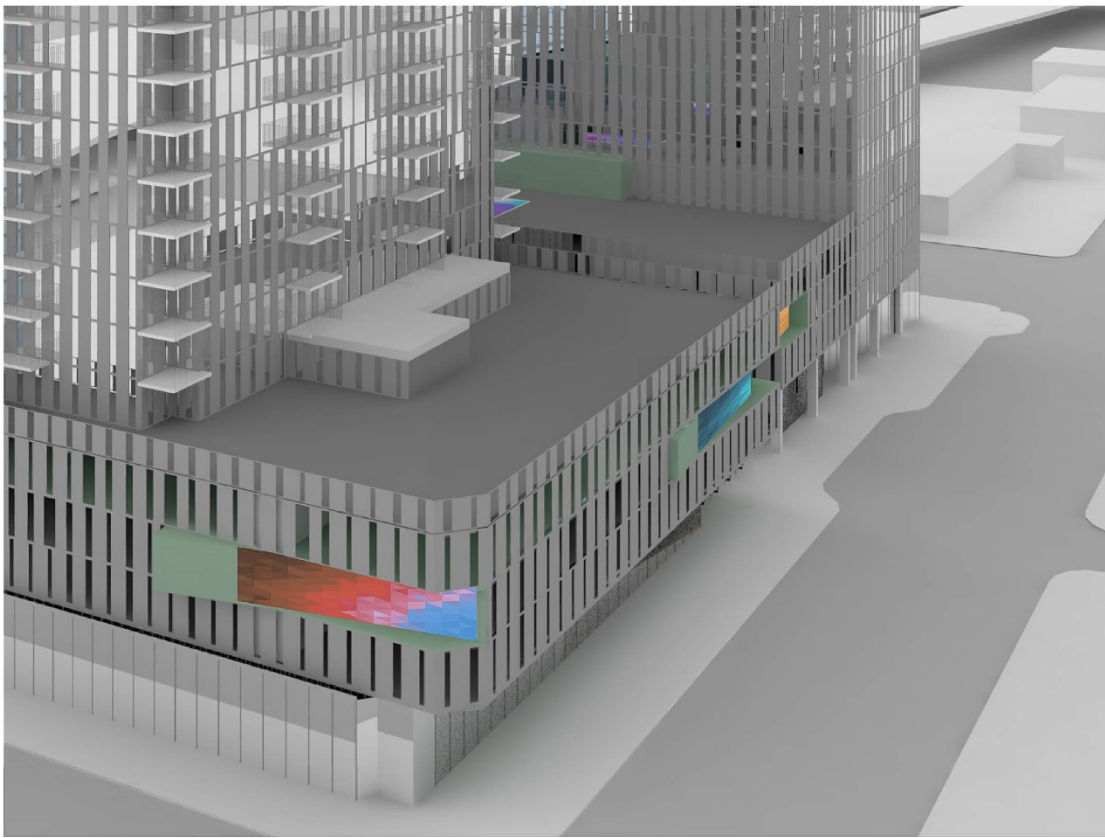
Specifically, the proposed Project would conform to the following standards:

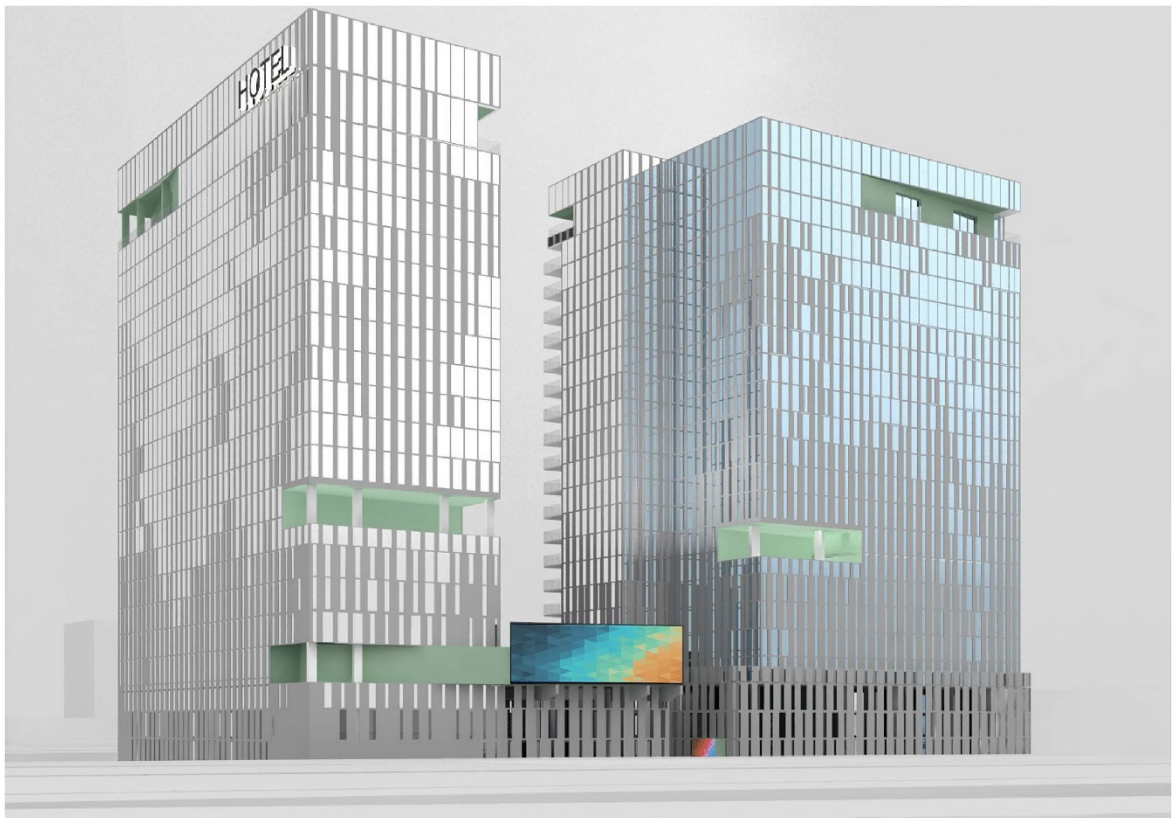
- Light Trespass illuminance from the Project Signs will be less than 3 fc at all sensitive use properties as stipulated by LAMC.
- During daytime, Glare at sensitive use, residential or roadway sites will be less than high contrast conditions with maximum sign luminance of 5000 cd/m².
- At night and during sunset, sunrise, and overcast conditions, Glare at sensitive use, residential or roadway sites will be less than high contrast conditions with a maximum sign luminance of 300 cd/m².
- Sign Lighting will be controlled by a photocell to transition smoothly from the maximum daytime luminance of 5,000 cd/m² to the maximum nighttime luminance of 300 candelas/m², beginning at 45 minutes prior to sunset and completed no later than 20 minutes prior to sunset to avoid potential high contrast, Glare conditions. Similarly, the Project Signs must transition from the night maximum luminance of 300 cd/m² to the day maximum luminance of 5,000 cd/m², beginning no earlier than 20 minutes after sunrise.
- Signs would reduce luminance during times of overcast weather to the required night luminance levels.

This analysis concludes the Project Signs will not create a new source of Light Trespass illuminance and or Glare at sensitive sites.





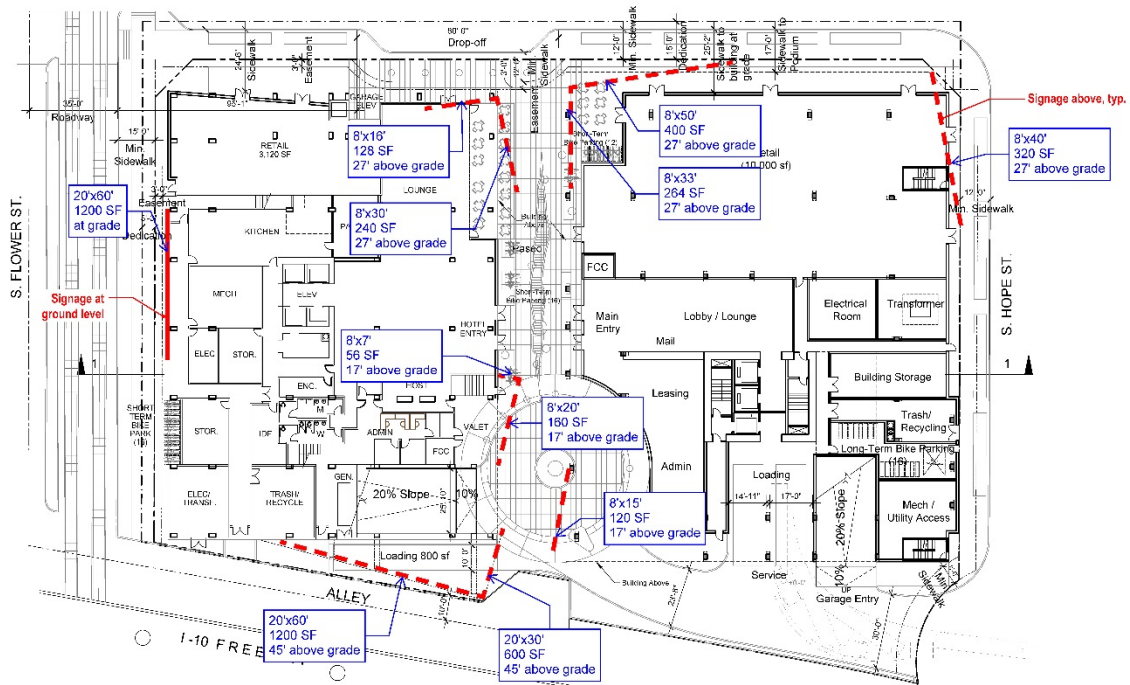






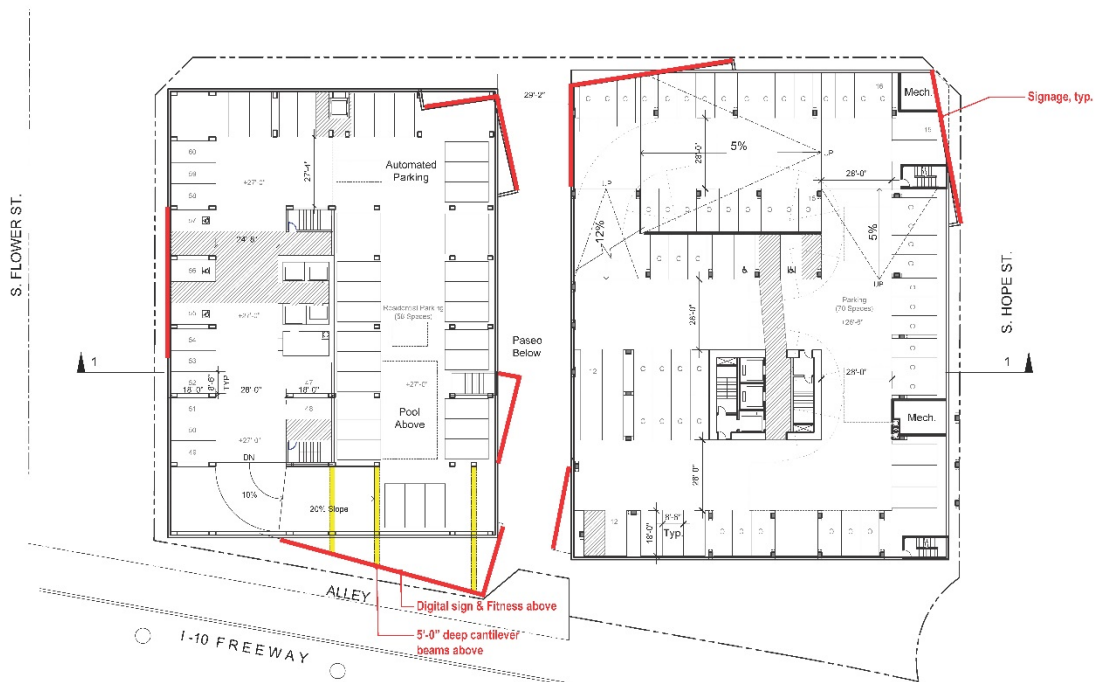
South Park Towers

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South Park Towers
Los Angeles, CA

Venice Hope Group, LLC

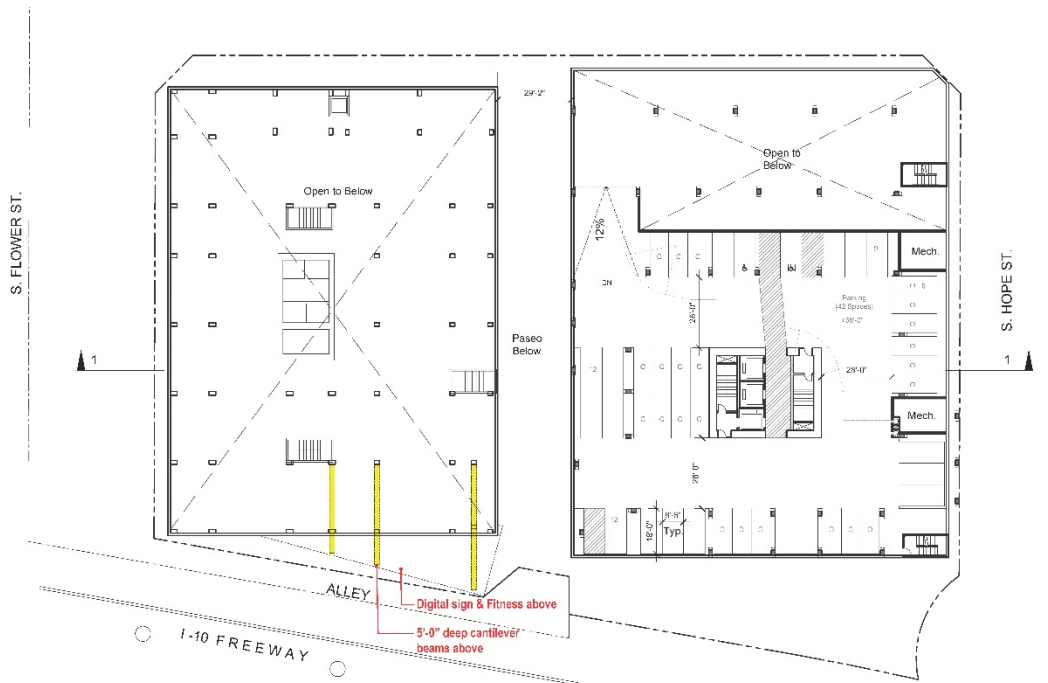


South Park Towers
Los Angeles, CA

Venice Hope Group, LLC

South Park Towers

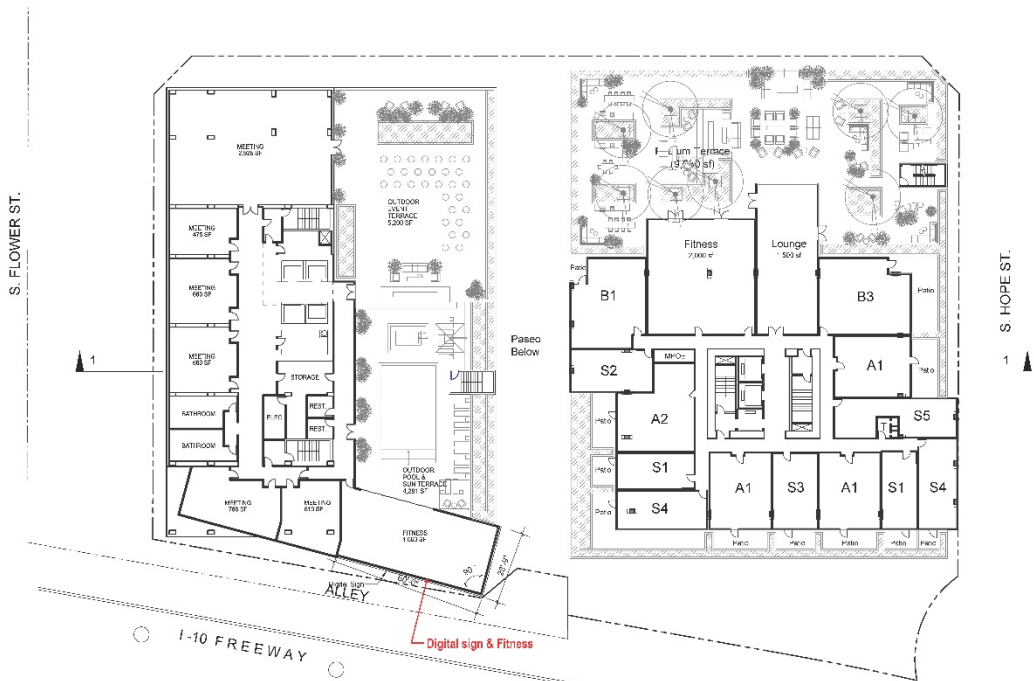
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4th Level Plan

South Park Towers
Los Angeles, CA

Venice Hope Group, LLC



Podium Level Plan (Level 5)

South Park Towers
Los Angeles, CA

Venice Hope Group, LLC

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.
- (d) **Commission Notification, Amended Outdoor Lighting Zone Designation.** Local jurisdictions who adopt changes to the State Default Lighting Zones shall notify the Commission by providing the following materials to the Executive Director:
 - 1. A detailed specification of the boundaries of the adopted Lighting Zones, consisting of the county name, the city name if any, the zip code(s) of the re-designated areas, and a description of the physical boundaries within each zip code;
 - 2. A description of the public process that was conducted in adopting the Lighting Zone changes; and
 - 3. An explanation of how the adopted Lighting Zone changes are consistent with the specifications of Section 10-114.
- (e) The Commission shall have the authority to not allow Lighting Zone changes which the Commission finds to be inconsistent with the specifications of Section 10-114.

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	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.	Not applicable.
LZ2	Moderate	Rural areas, as defined by the 2010 U.S. Census.	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 rural area.	Special districts and government designated parks within a default LZ2 zone may be designated as LZ1 by the local jurisdiction for lower illumination standards, without any size limits.
LZ3	Moderately High	Urban areas, as defined by the 2010 U.S. Census.	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 and government designated parks within a default LZ3 zone may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
LZ4	High	None.	Not applicable.	Not applicable.

APPENDIX C: IESNA 10th Edition Lighting Handbook, Table 26.4, Nighttime Outdoor Lighting Zone Definitions

Table 26.4 | Nighttime Outdoor Lighting Zone Definitions

Zone	Outdoor Lighting Situation	Definition
LZ4	High Ambient Lighting	Areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience and it is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline.
LZ3	Moderately High Ambient Lighting	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 and it is often uniform and/or continuous. After curfew, lighting may be extinguished or reduced in most areas as activity levels decline.
LZ2	Moderate Ambient Lighting	Areas of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, lighting may be extinguished or reduced as activity levels decline.
LZ1	Low Ambient Lighting	Areas where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of human residents and users is adapted to low light levels. Lighting may be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or reduced as activity levels decline.
LZ0	No Ambient Lighting	Areas where the natural environment will be seriously and adversely affected by lighting. Impacts include disturbing the biological cycles of flora and fauna and/or detracting from human enjoyment and appreciation of the natural environment. Human activity is subordinate in importance to nature. The vision of human residents and users is adapted to the darkness, and they expect to see little or no lighting. When not needed, lighting should be extinguished.

APPENDIX D: IESNA 10th Edition Lighting Handbook, Table 26.5, Recommended Light Trespass Illuminance Limits

Table 26.5 | Recommended Light Trespass Illuminance Limits

Lighting Zone	Limit in lux ^a	
	Pre-curfew	Post-curfew
LZ4	15	6
LZ3	8	3
LZ2	3	1
LZ1	1	0
LZ0	0.1	0

- a.** Maximum initial illuminance on a plane perpendicular to the line of sight to the luminaire(s). Plane located at observer position where light trespass is under review. [7]

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APPENDIX E: Sign Lighting Illuminance Calculation (fc)

Sign Lighting illuminance data presented below is derived from the lighting illuminance calculations prepared as per the methods described in Section 6.2 above. Illuminance data is presented in the following tables with location coordinates defined relative to the elevation and horizontal distance from lower left, viewing from the Property to the vertical plane where Light Trespass illuminance is under review. Grid data is displayed at ten feet on center, vertical and horizontal.

Vertical Plane VPE3

HORIZONTAL (ft)	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
75	0.19	0.20	0.22	0.24	0.27	0.30	0.33	0.38	0.44	0.50	0.56	0.64	0.71	0.78	0.82
65	0.19	0.20	0.24	0.25	0.28	0.32	0.36	0.42	0.48	0.55	0.64	0.74	0.84	0.92	0.98
55	0.20	0.21	0.24	0.26	0.29	0.33	0.38	0.44	0.52	0.60	0.71	0.83	0.95	1.05	1.12
45	0.20	0.21	0.23	0.26	0.29	0.34	0.40	0.46	0.54	0.65	0.77	0.90	1.04	1.15	1.24
35	0.20	0.21	0.24	0.27	0.30	0.34	0.41	0.47	0.57	0.67	0.80	0.94	1.09	1.22	1.31
25	0.20	0.21	0.23	0.26	0.29	0.34	0.40	0.47	0.56	0.66	0.78	0.94	1.10	1.23	1.32
15	0.19	0.21	0.23	0.25	0.28	0.33	0.38	0.46	0.53	0.64	0.75	0.91	1.04	1.17	1.25
5	0.18	0.20	0.22	0.24	0.27	0.31	0.35	0.42	0.49	0.59	0.69	0.81	0.94	1.04	1.11

Vertical Plane VPE3

HORIZONTAL (ft)	155	165	175	185	195	205	215	225	235	245	255	265	275	285	295
75	0.82	0.82	0.76	0.70	0.61	0.52	0.44	0.35	0.29	0.23	0.18	0.15	0.13	0.11	0.10
65	0.99	0.98	0.92	0.82	0.72	0.61	0.50	0.40	0.31	0.26	0.20	0.16	0.13	0.11	0.10
55	1.15	1.12	1.06	0.94	0.82	0.68	0.55	0.44	0.35	0.27	0.22	0.17	0.14	0.11	0.10
45	1.27	1.26	1.18	1.05	0.90	0.75	0.61	0.48	0.38	0.29	0.23	0.18	0.14	0.12	0.10
35	1.35	1.32	1.23	1.10	0.94	0.77	0.62	0.48	0.38	0.29	0.22	0.18	0.14	0.11	0.09
25	1.35	1.33	1.25	1.11	0.94	0.77	0.62	0.49	0.39	0.29	0.23	0.17	0.14	0.11	0.09
15	1.29	1.27	1.19	1.05	0.89	0.74	0.60	0.47	0.37	0.28	0.22	0.17	0.13	0.11	0.08
5	1.15	1.13	1.06	0.94	0.81	0.67	0.54	0.43	0.34	0.27	0.21	0.16	0.12	0.10	0.08

Vertical Plane VPE3

HORIZONTAL (ft)	305	315	325	335	345	355	365	375	385	395	405	415	425	435	445
75	0.09	0.12	0.46	0.53	0.57	0.59	0.60	0.54	0.53	0.50	0.39	0.36	0.34	0.22	0.20
65	0.09	0.12	0.43	0.51	0.55	0.57	0.59	0.53	0.52	0.51	0.39	0.36	0.34	0.21	0.20
55	0.09	0.10	0.31	0.49	0.52	0.55	0.56	0.48	0.48	0.48	0.36	0.34	0.32	0.20	0.19
45	0.09	0.08	0.09	0.38	0.44	0.50	0.53	0.48	0.46	0.45	0.35	0.33	0.31	0.20	0.18
35	0.08	0.08	0.08	0.36	0.42	0.46	0.50	0.47	0.45	0.45	0.35	0.33	0.31	0.20	0.18
25	0.08	0.07	0.07	0.35	0.41	0.44	0.47	0.43	0.43	0.43	0.34	0.32	0.30	0.19	0.18
15	0.07	0.06	0.06	0.35	0.38	0.42	0.45	0.41	0.41	0.41	0.32	0.31	0.29	0.18	0.17
5	0.06	0.05	0.05	0.33	0.37	0.40	0.43	0.38	0.38	0.38	0.30	0.28	0.27	0.17	0.16

Vertical Plane VPE3

HORIZONTAL (ft)	455	465	475	485	495	505	515	525	535	545
75	0.18	0.07	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01
65	0.18	0.06	0.06	0.05	0.01	0.01	0.01	0.01	0.01	0.01
55	0.17	0.06	0.06	0.05	0.01	0.01	0.01	0.01	0.01	0.01
45	0.17	0.06	0.06	0.05	0.01	0.01	0.01	0.01	0.01	0.01
35	0.17	0.06	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01
25	0.16	0.06	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01
15	0.15	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01
5	0.15	0.05	0.05	0.04	0.01	0.01	0.01	0.01	0.01	0.01

Vertical Plane VPN1

HORIZONTAL (ft)	5	15	25	35	45	55	65	75	85	95	105	115	125	135
75	0.30	0.27	0.29	0.31	0.35	0.40	0.49	0.57	0.70	0.79	0.91	1.01	1.12	1.25
65	0.31	0.28	0.29	0.32	0.36	0.43	0.52	0.61	0.74	0.87	1.01	1.14	1.28	1.43
55	0.30	0.27	0.29	0.32	0.37	0.44	0.54	0.66	0.81	0.95	1.10	1.26	1.42	1.60
45	0.30	0.27	0.28	0.31	0.37	0.43	0.54	0.67	0.82	1.00	1.15	1.36	1.54	1.73
35	0.29	0.25	0.27	0.31	0.36	0.43	0.54	0.67	0.83	1.03	1.20	1.40	1.60	1.80
25	0.28	0.23	0.25	0.30	0.35	0.44	0.54	0.66	0.83	1.02	1.22	1.40	1.61	1.81
15	0.26	0.21	0.24	0.28	0.34	0.43	0.53	0.64	0.82	0.99	1.15	1.36	1.55	1.75
5	0.23	0.19	0.22	0.27	0.32	0.41	0.51	0.63	0.76	0.92	1.07	1.24	1.40	1.59

Vertical Plane VPN1

HORIZONTAL (ft)	145	155	165	175	185	195	205	215	225	235	245	255	265	275
75	1.41	1.54	1.62	1.65	1.70	1.67	1.59	1.49	1.30	1.10	0.91	0.73	0.59	0.47
65	1.62	1.80	1.90	1.98	2.04	2.01	1.92	1.77	1.55	1.30	1.05	0.85	0.67	0.52
55	1.83	2.05	2.19	2.29	2.38	2.34	2.26	2.09	1.79	1.50	1.21	0.95	0.74	0.57
45	1.99	2.23	2.42	2.55	2.67	2.64	2.55	2.34	2.01	1.66	1.32	1.04	0.80	0.61
35	2.08	2.36	2.56	2.69	2.82	2.81	2.71	2.48	2.13	1.75	1.38	1.07	0.81	0.62
25	2.10	2.40	2.56	2.71	2.84	2.83	2.74	2.49	2.14	1.76	1.39	1.07	0.82	0.62
15	2.01	2.25	2.45	2.56	2.69	2.68	2.58	2.37	2.03	1.67	1.32	1.03	0.78	0.59
5	1.81	2.02	2.16	2.27	2.37	2.40	2.32	2.12	1.81	1.49	1.19	0.94	0.72	0.55

Vertical Plane VPN1

HORIZONTAL (ft)	285	295	305	315	325
75	0.37	0.30	0.25	0.23	0.27
65	0.41	0.33	0.26	0.25	0.30
55	0.45	0.35	0.28	0.26	0.32
45	0.47	0.37	0.29	0.27	0.34
35	0.47	0.36	0.29	0.27	0.33
25	0.47	0.36	0.28	0.26	0.33
15	0.45	0.35	0.27	0.25	0.31
5	0.42	0.31	0.24	0.22	0.28

Vertical Plane VPS4

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

Vertical Plane VPS4

HORIZONTAL (ft)	145	155	165
75	0.27	0.28	0.30
65	0.27	0.29	0.29
55	0.28	0.29	0.29
45	0.28	0.29	0.29
35	0.27	0.28	0.29
25	0.27	0.28	0.28
15	0.27	0.28	0.29
5	0.26	0.27	0.28

Vertical Plane VPS5

HORIZONTAL (ft)

	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
75	0.16	0.15	0.15	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.09
65	0.16	0.15	0.14	0.14	0.13	0.13	0.13	0.12	0.12	0.11	0.10	0.10	0.10	0.09	0.09
55	0.14	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.09	0.09	0.09	0.08
45	0.15	0.14	0.13	0.13	0.12	0.12	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.08
35	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.08
25	0.15	0.15	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.09	0.09	0.09
15	0.15	0.15	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.09
5	0.15	0.14	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.08

Vertical Plane VPS6

HORIZONTAL (ft)

	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
75	0.08	0.08	0.09	0.09	0.08	0.10	0.10	0.11	0.10	0.12	0.13	0.13	0.13	0.14	0.15
65	0.08	0.08	0.09	0.09	0.08	0.10	0.10	0.11	0.11	0.12	0.13	0.13	0.13	0.14	0.16
55	0.08	0.07	0.09	0.09	0.08	0.10	0.10	0.11	0.10	0.12	0.12	0.13	0.13	0.14	0.15
45	0.08	0.07	0.09	0.09	0.08	0.10	0.09	0.11	0.10	0.12	0.12	0.13	0.13	0.14	0.15
35	0.08	0.08	0.09	0.09	0.08	0.10	0.09	0.10	0.10	0.12	0.12	0.12	0.12	0.14	0.16
25	0.08	0.07	0.08	0.09	0.08	0.10	0.09	0.11	0.10	0.12	0.13	0.12	0.13	0.14	0.15
15	0.08	0.07	0.08	0.09	0.08	0.10	0.09	0.11	0.10	0.12	0.12	0.12	0.13	0.14	0.15
5	0.08	0.07	0.08	0.09	0.08	0.09	0.09	0.11	0.10	0.11	0.12	0.12	0.13	0.13	0.15

Vertical Plane VPS7
HORIZONTAL (ft)

	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
75	0.36	0.35	0.34	0.33	0.32	0.33	0.33	0.32	0.30	0.29	0.28	0.28	0.27	0.26	0.25
65	0.37	0.37	0.36	0.35	0.34	0.32	0.32	0.32	0.31	0.30	0.30	0.28	0.27	0.26	0.25
55	0.34	0.33	0.33	0.33	0.31	0.30	0.29	0.29	0.28	0.27	0.27	0.26	0.25	0.25	0.23
45	0.32	0.31	0.30	0.30	0.30	0.29	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.24	0.23
35	0.35	0.34	0.33	0.33	0.32	0.32	0.30	0.29	0.28	0.28	0.28	0.27	0.26	0.26	0.25
25	0.35	0.34	0.34	0.33	0.31	0.31	0.30	0.30	0.29	0.29	0.28	0.27	0.27	0.25	0.24
15	0.34	0.34	0.33	0.31	0.31	0.30	0.30	0.29	0.29	0.28	0.27	0.26	0.26	0.25	0.25
5	0.34	0.33	0.32	0.32	0.31	0.31	0.30	0.28	0.28	0.28	0.27	0.26	0.25	0.25	0.24

Vertical Plane VPW1

HORIZONTAL (ft)

	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
75	0.05	0.05	0.06	0.06	0.06	0.07	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.12	0.14
65	0.05	0.04	0.05	0.06	0.06	0.07	0.07	0.08	0.09	0.10	0.10	0.12	0.13	0.13	0.14
55	0.04	0.05	0.06	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.11	0.11	0.12	0.13	0.14
45	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.09	0.09	0.11	0.11	0.12	0.13	0.14
35	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.14
25	0.04	0.04	0.05	0.05	0.06	0.07	0.07	0.08	0.08	0.09	0.10	0.11	0.11	0.12	0.14
15	0.04	0.04	0.05	0.05	0.05	0.07	0.07	0.07	0.08	0.09	0.10	0.11	0.12	0.12	0.13
5	0.04	0.05	0.06	0.06	0.05	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.11	0.11	0.13

Vertical Plane VPW2

HORIZONTAL (ft)	5	15	25	35	45	55	65	75	85	95	105	115	125	135
75	0.26	0.25	0.23	0.22	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.14	0.13
65	0.26	0.25	0.23	0.22	0.22	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.13	0.13
55	0.27	0.24	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.17	0.15	0.15	0.14	0.13
45	0.27	0.25	0.23	0.22	0.21	0.20	0.20	0.19	0.17	0.17	0.15	0.15	0.14	0.13
35	0.27	0.25	0.23	0.23	0.22	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.13
25	0.27	0.25	0.24	0.23	0.22	0.21	0.20	0.18	0.17	0.17	0.16	0.15	0.14	0.13
15	0.26	0.24	0.23	0.22	0.19	0.19	0.19	0.17	0.17	0.16	0.15	0.15	0.14	0.13
5	0.25	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.17	0.16	0.15	0.15	0.14	0.13

Vertical Plane VPW2

HORIZONTAL (ft)	145	155
75	0.12	0.12
65	0.12	0.12
55	0.13	0.12
45	0.12	0.11
35	0.12	0.11
25	0.12	0.11
15	0.12	0.12
5	0.12	0.11