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**101 Tech
Signage Evaluation Report**

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Lighting Design Alliance was retained to perform a lighting evaluation on the effects of the proposed illuminated programmable electronic freeway sign to be installed on U.S. 101 Tech Office/R&D site, located in San Jose, California. This report evaluates the potential lighting effects on motorists on the 101 Freeway, Airport Control Tower operators, and pilots for the San Jose International Airport. Projected light levels and lighting effects to the Guadalupe River channel bed are also addressed.

3.1 Background Information

In 2012, a Site Development Permit was approved for a 12.9 acre site in North San Jose at the westerly terminus of Atmel Way, northwest of U.S. 101/State Route 87 (SR 87) interchange. The Site Development Permit allows development of the site with the 101 Tech Office R&D development which includes up to 666,000 square feet (sf) of industrial buildings. Prior to approval of the Site Development Permit, an Addendum was prepared to the Final Environmental Impact Report (EIR) for the North San Jose Area Development Policies Update (SCH # 2004102067) and Final Program EIR for the Envision San Jose 2040 General Plan (SCH #2009072096). The Addendum concluded that the North San Jose Area Development Policies Update Final EIR and Envision San Jose 2040 General Plan Final Program EIR adequately addressed the environmental effects of the 101 Tech Office/R&D Project, and the project would not result in significant environmental effects that were not already identified in the Final EIRs.

The 101 Tech Office/R&D site has under 500 feet of local surface street frontage and approximately 1,000 feet of highway and highway ramp frontage. To improve visibility of tenants of the site, the project proposes a revision to the existing Site Development Permit to allow installation of a sign adjacent to the freeway. The U.S. 101 Tech Sign project proposes installation of a double-sided, freestanding programmable electronic freeway sign at the planned 101 Tech Office/R&D development site in North San José. The signage is referred to as a Programmable Electronic Freeway Sign in this report. Title 23 of the City's Municipal Code (Sign Code) does not allow signs adjacent to freeways on office/R&D properties. Implementation of the project would, therefore, require an amendment to the City's Sign Code.

3.1.1 Definition of Terms Used in the Report

Brightness

Brightness is the perceptual response to luminance. It is our response to a source of light, with sources being categorized between bright and dim. (Section 4.8 of the IESNA Lighting Handbook)

Candela

Basic unit for measuring luminous intensity from a light source in a given direction. A common candle emits light with a luminous intensity of roughly one candela. If emission in some directions is blocked by an opaque barrier, the emission would still be approximately one candela in the direction that is not obscured.

Digital Display

A sign face, building face, and/or any building or structural component that displays still images, scrolling images, moving images, or flashing images, including video and animation, through the use of grid lights, cathode ray projection, light emitting diode displays, plasma screens, liquid crystal displays, fiber optics, or other electronic media or technology that is either independent of or attached to, integrated into, or projected onto a building or structural component, and that may be changed remotely through electronic means.

Footcandle (FC)

An imperial unit of measurement, abbreviated as FC. The unit is defined as the amount of illumination the inside surface of an imaginary 1 foot radius sphere would be receiving if there were a uniform point source of one candela in the exact center of the sphere. The footcandle can be thought of as the amount of light that actually falls on a given surface. The footcandle is equal to one lumen per square foot. Footcandles are additive.

Face of Building

The general outer surface, not including cornices, bay windows or architectural projections, of any exterior wall of a building.

Illuminance

The areal density of the luminous flux incident at a point on a surface. The unit of illumination is footcandle.

LED - Light Emitting Diode

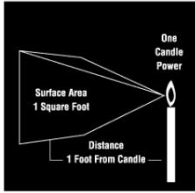
A pn-junction semiconductor device that emits incoherent optical radiation when forward biased.

LED Luminaire

A complete lighting unit consisting of LED-based light emitting elements and a matched driver together with parts to distribute light, to position and protect the light emitting elements, and to connect the unit to a branch circuit. The LED-based light emitting elements may take the form of LED packages (components), LED arrays (modules).

Lumen

A lumen is the basic unit of light, a measure of the perceived power of light. The lumen is defined in relation to the candela by 1 lumen = 1 candela x 1 steradian.



Luminance

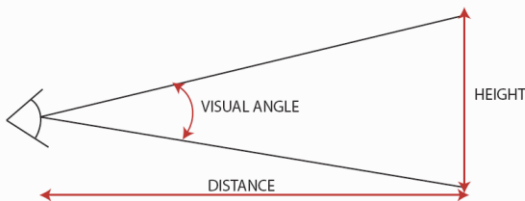
Is a photometric measure of the luminous intensity of a surface. The luminance indicates how much luminous power will be detected by an eye looking at the surface from a particular angle of view. It is an indicator of how bright the surface will appear. The standard international (SI) unit of measurement for luminance is candelas per meter squared (cd/m²). The non-SI term for the same unit is the “nit”. (Section 12.18 of the IESNA (Illuminating Engineering Society of North America) Lighting Handbook)

Nit

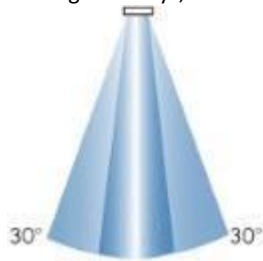
As described above, under ‘Luminance,’ the standard international (SI) unit of measurement for luminance is candelas per meter squared (cd/m²). The non-SI term for the same unit is the “nit”. (Section 12.18 of the IESNA (Illuminating Engineering Society of North America) Lighting Handbook)

Visual Angle

The angle formed by two rays of light, or two straight lines drawn from the extreme points of an object to the center of the eye.



Viewing angles are defined as where the intensity of the LEDs are at 50% of their maximum brightness when a traveler is viewing the signage from a straight position. For example, at 15 degrees off-center, the LED brightness in a standard 30 degree viewing cone would be 50% of the maximum intensity. Viewing angles vary on the variation of the installation site. Factors like curving roadways, shoulder-mounted sign locations, and side visibility are some of the factors that affect the viewing angles.



*Desired viewing cone would be the narrower angle so that at 70 degrees the brightness is cut in half

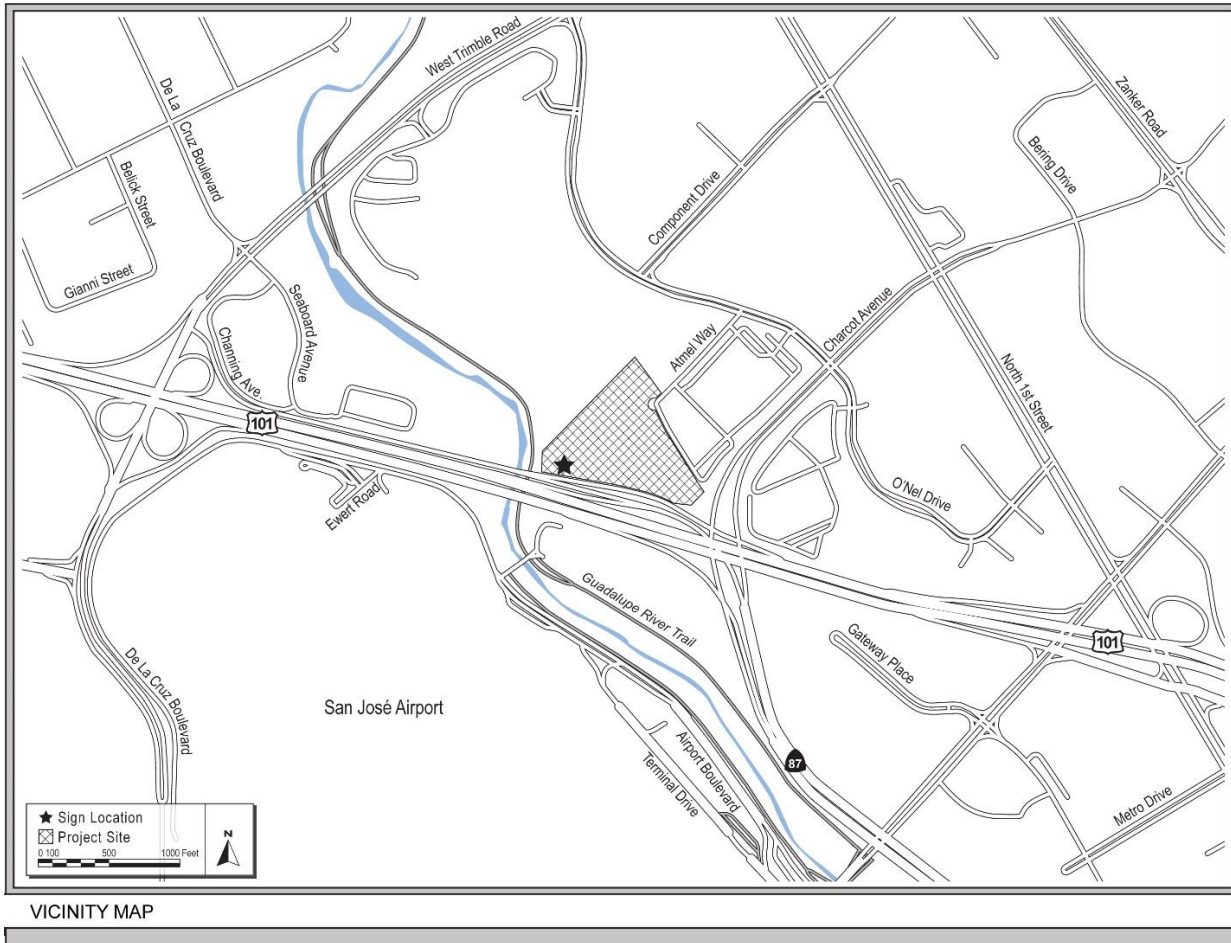
3.2 Description of Proposed Sign

The proposed project (US 101 Tech Sign Project) is the installation of a double-sided, freestanding programmable electronic freeway sign at the planned 101 Tech Office/R&D site in North San José. The proposed sign would be just outside the 100 foot riparian setback area along the south side of the Guadalupe River, and approximately 1,900 feet east of Runway 30R-12L at the Norman Y. Mineta San José International Airport. Sign construction would take two to four weeks to complete. A map showing

the location of the project site is provided in Figure 3.2-1 and a site plan showing the location of the sign is provided in Figure 3.2-2.

The approximate location of the sign is 110'-0" to the center of the Trimble Road Off-Ramp, and another 110'-0" from that point to the main lanes of U.S. 101.

Figure 3.2-1: LOCATION OF PROPOSED SIGN

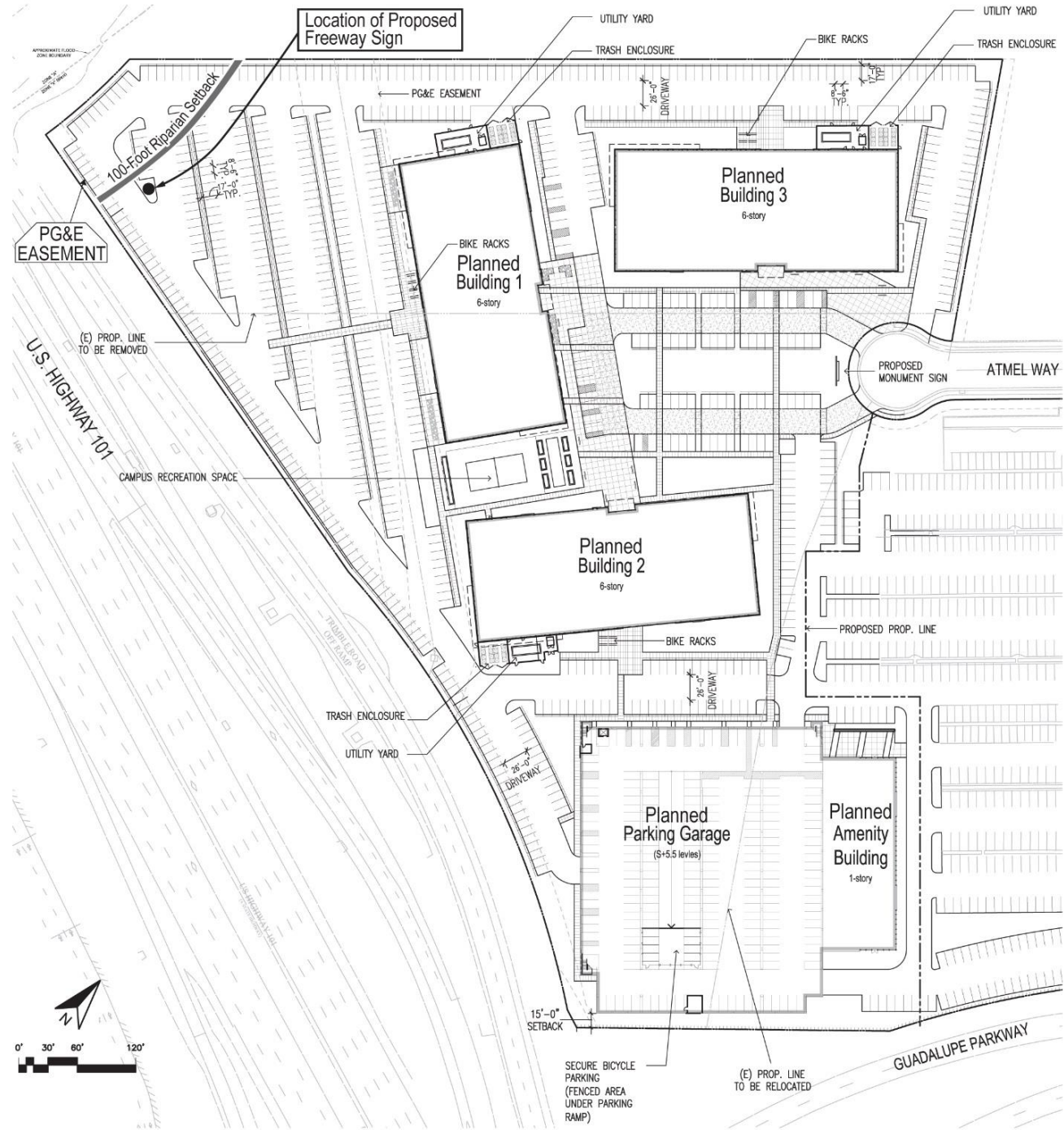


3.2.1 Sign Characteristics

The proposed sign structure would be up to 60 feet in height and oriented to freeway lane views from northbound and southbound US 101. The maximum overall sign area would not exceed 500 sf per side and the programmable electronic sign surface would not exceed 375 sf (12.5 feet by 30 feet).

The sign displays are expected to be center mounted on a single supporting column, but might require up to two supporting columns. The foundation used for the proposed structure would be a drilled shaft with a poured concrete footing. The column foundation would be five to six feet in diameter and would extend to a depth of approximately 18 to 35 feet below the ground surface (bgs). A conceptual illustration of the proposed sign is shown in Figure 3.2-2.

Figure 3.2-2: CONCEPTUAL ILLUSTRATION OF PROPOSED ELECTRONIC SIGN



LOCATION OF PROPOSED SIGN

3.2.2 Sign Operations

The illuminated double-sided sign would operate in accordance with applicable federal and state regulations¹ for signs near freeways, and would conform to the operational standards of the City of San Jose's current Sign Code for programmable electronic signs, as specified in Section 23.02.905 of the City's Sign Code.

The City's Sign Code details regulations to avoid visual impairments to motorists. These regulations include limits on effects that give the appearance of movement (flashing, blinking, fading, etc.), audio, message transitions, message timing, and lighting (including ambient light, brightness, and other visual impairment issues such as message content).

In accordance with Section 23.02.905 (C)(1) of the Sign Code, the sign would not change more than once every eight (8) seconds. The brightness of the sign would result in a difference between the ambient light measurement and the operating sign light measurement of less than three tenths foot candles, with measurements taken at a distance of two hundred feet from the sign. The sign would use automatic dimming technology to adjust the brightness of the sign relative to ambient light.

In accordance with the California Vehicle Code (Section 21466.5), the brilliance of the sign would have a maximum light output not exceeding 1,000 times the minimum measured brightness in a driver's field of view, within ten degrees of that field of view.

In conformance with the City's Sign Code, the programmable electronic sign faces could be operated 24 hours per day.

The Programmable Electronic Freeway Sign will display only static graphics during operation. As noted above, the programmable sign faces would be subject to limits on brightness levels which will impact the brightness that the sign adds to the ambient light level. The signage is to be equipped with sensors that modify the brightness of the sign in response to ambient lighting conditions and would be required to occur gradually, to prevent a sudden change in perceptible brightness levels by motorists. The limits on brightness for daylight and for nighttime from roadway regulations measured in footcandles at 200 feet for the proposed sign is equivalent to an output of 4,500 candelas per square meter (cd/m² or nits) during the daytime and 300 cd/m² during the nighttime on the digital displays. The City of San Jose's Sign Code has very clearly stated regulations on brightness and how to survey the sign's brightness when installed, which will be discussed in greater detail further in the report.

3.3 Report Scope and Evaluation Process

The scope of this report was limited to the evaluation of the impact to motorists traveling on U.S. Highway 101, the critical or visual impact on landing or approaching aircraft and direct views for air traffic controllers operating out of the Control Tower on the Southwest side of the runway from the proposed sign described above. Illuminance of the Guadalupe River channel bed was also estimated.

As this report was written prior to construction of the 101 Tech Office project, and the proposed Programmable Electronic Freeway Sign was not installed on site, an official study of brightness and illuminance on site could not be performed. Light reading measurements taken from similar existing lighting features in the area as provided for a previous signage study and report done for the City of San José are used to illustrate existing lighting conditions in the vicinity of San José International Airport and U.S. 101.

3.3.1 Project Assumptions

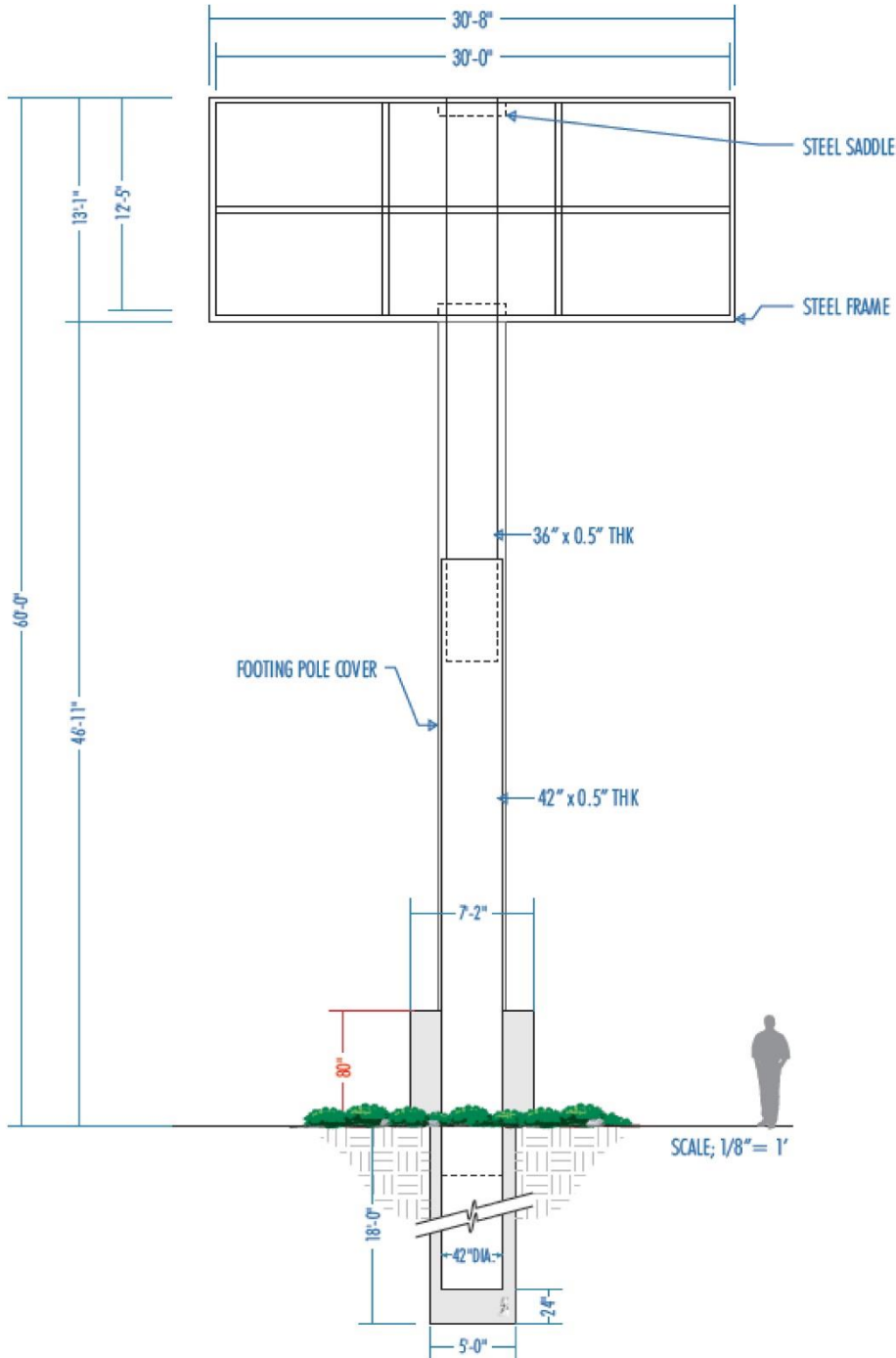
The proposed Project includes (1) Programmable Electronic Freeway Sign. The Programmable Electronic Freeway Sign would consist of (2) LED digital display signs with proposed measurements of 30'-0" long by 12'-6" high. The digital display signs would be mounted to a pylon frame structure atop one or two column support posts, standing at 60'-0" maximum above grade.

A digital display sign is a matrix of LEDs capable of displaying several digital messages/images in a rotation. These display panels are highly adaptable to display stationary advertisements, or announcements. These media display panels integrate ambient light sensors to automatically reduce screen brightness depending on exterior light conditions. This is critical. Daytime ambient light readings vary throughout the day, but afternoon intensities can exceed 9,000 footcandles. Conversely, at night the ambient light level is less than a single footcandle. In order for the signs to be visible during the day, the digital display would be at full or near-full brightness during a sunny day. This intensity of sign brightness would be extreme at night, so the sign would be dimmed to more appropriate lower intensities at night, in conformance with City Sign Code requirements.

¹ Applicable laws and regulations include the Federal Highway Beautification Act, and the California Vehicle Code.

The proposed Programmable Electronic Freeway Sign would be located parallel to the side of the northbound U.S. 101/SR 87 Highway interchange. The signage element would be installed roughly 1.1 miles away from the Airport Control Tower and 1,700 feet away from the edge of the Airport Terminal Building. The center of the sign is approximately 53.5 feet above ground level, and the viewing height on the Air Traffic Control Tower Observation deck is approximately 89 feet above ground level. The height of the Airport Terminal Building is approximately 62'-0" above ground level, but it is to be noted that for the view from the Air Traffic Control Tower, the Airport Terminal Building does not block the view of the Programmable Electronic Freeway Sign. The sign element is positioned towards the Air Traffic Control Tower so that there is only 10 degrees of visibility from the main viewing angle of the tower not in direct view of the full sign element.

Figure 3.3-1: ELEVATION OF PROPOSED SIGNAGE



CONCEPTUAL ILLUSTRATION OF PROPOSED ELECTRONIC SIGN

3.4 City of San Jose Sign Code and Compliance

The following are portions of the City's Sign Code that are relevant to the proposed project. These definitions and regulations will govern the sign and its operations.

Terms in City Sign Code:

23.02.040 Animated Sign

"Animated sign" means a sign having action, motion, movement, changeable copy, or flashing color changes that are activated by electrical energy, electronic energy or other manufactured sources of energy supply, but not including wind-activated movement such as in flags, banners or pennants, or mechanical movement signs. Animated signs include grids of flashing lights or mechanical elements in patterns that give the perception of movement, as in chasing lights or programmable displays. For purposes of this title, an animated sign shall not be considered a mechanical movement sign if the only mechanical movement in the sign relates to the movement of grids to produce programmable displays."

23.02.236 Freeway Sign

"Freeway sign" means a large freestanding sign oriented to and designed to be viewed from a freeway."

23.02.270 Internal Lighting

"Internal lighting" means the illumination of a sign by a light source that is fully incorporated into the sign itself."

23.02.280 Light Source

"Light source" means a device which, when activated (electronically or otherwise), emits light. Light sources include, but are not limited to, incandescent filament bulb, electric discharge bulb, neon tube and fluorescent tube."

23.02.500 Sign

"Sign" means any structure, display, device, balloon or graphic on or attached to any land, building or structure, which is used to communicate any message, or which advertises or promotes any business, product, activity, person or interest. Signs include, but are not limited to, letters, numbers, words, illustrations, decorations, decals, emblems, trademarks, logos and lights. Signs do not include noncommercial murals otherwise allowed under this Code."

23.02.502 Sign Area

"Sign area" has the same meaning as area of sign, as defined in Section 23.02.050 of this Code."

23.02.970 Illuminated Signs – Light Source

"A. Every part of the light source of any illuminated sign allowed by this title shall be concealed from view from vehicular traffic in the public right-of-way, and the light shall not travel from the light source directly to vehicular traffic in the public right-of-way but instead shall be visible only from a reflecting or diffusing surface.

B. This provision shall not apply to neon tube lighting expressly permitted by another provision of this title."

Regulations in City Sign Code:

23.02.905 Limitations on Programmable Electronic Signs

"Programmable electronic signs and programmable electronic kiosks shall conform to the following:

A. No sign shall display animated messages, including flashing, blinking, fading, rolling, shading, dissolving, or any other effect that gives the appearance of movement.

B. No sign shall include any audio message.

C. No sign message shall be displayed for a period of time less than:

1. Eight seconds on any sign located within four hundred feet of a freeway travel lane or on any sign the illuminated face of which is visible from a freeway travel lane; or

2. Four seconds on any other sign.

D. Transition from one message to another message shall appear instantaneous as perceived by the human eye.

E. Each sign message shall be complete in itself and shall not continue on a subsequent sign message.

F. Signs shall utilize automatic dimming technology to adjust the brightness of the sign relative to ambient light so that at no time shall a sign exceed a brightness level of three-tenths foot candles above ambient light, as measured using a foot candle (Lux) meter and in conformance with the following process:

1. Light measurements shall be taken with the meter aimed directly at the sign message face, or at the area of the sign emitting the brightest light if that area is not the sign message face, at the following distances:

a. A sign that is zero to one hundred square feet in area shall be measured at a distance of one hundred feet from the sign area being measured;

- b. A sign that is one hundred one to three hundred fifty square feet in area shall be measured at a distance of one hundred fifty feet from the sign area being measured;
 - c. A sign that is three hundred fifty-one to six hundred fifty square feet in area shall be measured at a distance of two hundred feet from the sign area being measured;
 - d. A sign that is six hundred fifty-one to one thousand square feet in area shall be measured at a distance of two hundred fifty feet from the sign area being measured; and
 - e. A sign that is over one thousand square feet in area shall be measured at a distance of three hundred fifty feet from the sign area being measured.
2. An ambient light measurement shall be taken using a foot candle meter at some point between the period of time between thirty minutes past sunset and thirty minutes before sunrise with the sign turned off to a black screen.
3. Immediately following the ambient light measurement taken in the manner required by this subsection, an operating sign light measurement shall be taken with the sign turned on to full white copy.
4. The brightness of a sign conforms with the brightness requirements of this subsection if the difference between the ambient light measurement and the operating sign light measurement is three tenths foot candles or less.
- G. All signs shall contain a default mechanism that will cause the sign to revert immediately to a black screen if the sign malfunctions.
- H. Programmable electronic signs shall be located in a manner that the director determines based on reasonable evidence will not adversely interfere with the visibility or functioning of traffic signals and traffic signage, taking into consideration the physical elements of the sign and the surrounding area, such as information analyzing physical obstruction issues, line of sight issues, brightness issues and visual obstruction or impairment issues, but not including the message content on the sign.
- I. Programmable electronic signs may display only on-site commercial or noncommercial messages.
- J. Programmable electronic signs subject to the provisions of Part 4 of Chapter 23.04 of this title shall not be illuminated between the hours of 10:00 p.m. and 6:00 a.m.
- K. Signs attached to an historic building or structure shall not negatively impact the historic resource and shall conform to the following standards:
- 1. Signs shall be attached in a manner that does not irreversibly damage the building surface in a visible location.
 - 2. Signs shall not cover or obscure from view a character-defining architectural feature of the historic building.”

23.04.035 Freeway Signs

- A. Quantity.
- 1. One freeway sign may be allowed on any shopping center site that is fifteen acres or more in size and located not more than two hundred fifty feet from a freeway travel lane.
- B. Size.
- 1. No freeway sign shall have an area in excess of five hundred square feet.
- C. Height.
- 1. No freeway sign shall exceed sixty feet in height above surrounding grade.
 - 2. Exception:
 - a. The height of a freeway sign may exceed sixty feet above grade if the director determines that all of the following conditions exist:
 - i. The elevation of existing grade immediately adjacent to the freeway sign is more than ten feet below the elevation of a freeway travel lane located no greater than five hundred feet from the freeway sign; and
 - ii. The difference in grade pursuant to Section 23.04.040C.2. cannot be resolved by moving the sign and that difference in grade obscures visibility of the sign from the freeway; and
 - iii. The height of the freeway sign above surrounding grade does not exceed one hundred feet; and
 - vi. The height of a freeway sign located closer than four hundred feet from any residential dwelling unit does not exceed eighty feet in height above grade; and
 - v. The freeway sign conforms to all other provisions of this title.
- D. Location.
- 1. A freeway sign shall be located as close as possible to the nearest freeway travel lane.
 - 2. A freeway sign that includes a programmable electronic sign shall be located no closer than one hundred fifty feet from any residential dwelling unit.
- E. Other provisions.
- 1. A freeway sign may include a programmable electronic sign that does not exceed seventy-five percent of the total sign area and is integrated with the total sign to form a cohesive design unit. In no case shall a programmable electronic sign exceed three hundred and seventy-five square feet in area.
 - 2. The illuminated face of any freeway sign shall be oriented towards the freeway and shall be oriented away from nearby residential dwelling units to the maximum extent feasible.
 - 3. Any programmable electronic sign shall conform to the requirements of Section 23.02.905.
 - 4. Notwithstanding the provisions of Section 23.02.1300C., a freeway sign shall require approval of a development permit.
 - 5. Notwithstanding the provisions of Section 23.02.1010A.9., a freeway sign may face and be visible from a freeway.

3.5 Existing Conditions

Documentation and site readings that were taken previously for a separate signage study for the City of San José in October 2014 are included to provide information on the existing setting in the project vicinity. The information consists of brightness levels taken from different signs and bright objects from the vantage point of the Airport Control Tower. One of the areas of concern is the view from the Airport Control Tower to the proposed Programmable Electronic Freeway Sign. The October 2014 luminance readings would still be relevant to the Programmable Electronic Freeway Sign, which would be partially visible from the Airport Control Tower. The brightness of an existing Programmable Electronic Sign on the side of the highway is also documented. This electronic sign was documented from Raymond Street and Duane Avenue off of U.S.101.

A. San Jose Airport Control Tower – Visible Brightness Observed from Tower

The Tower inspection on October 10th, 2014, included an independent visual review of the surrounding existing conditions by Lighting Design Alliance staff and informal interview of Tower staff, both air traffic controllers and their manager. The evaluation was conducted at 2:30 PM, under full daylight condition with clear skies, as well as, a night evaluation at 9:00 PM, also with clear skies and no daylight effects. Airport Control Tower workers (air traffic controllers) were interviewed at 2:30 PM and also at 9:00 PM to identify to issues with existing brightness around the airport site, and how the issues impact ACT worker visibility and the visibility of pilots flying into the airport.

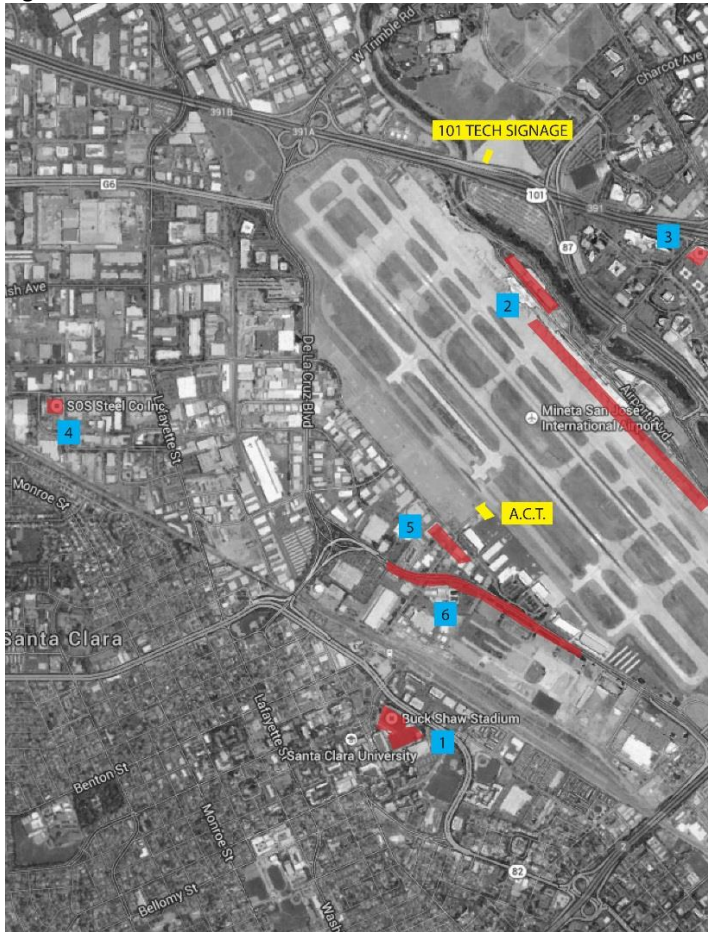
According to the air traffic controllers and reports from pilots, the primary, existing visual hazard is the Levi's Stadium located roughly 3.5 miles away at the intersection of Tasman Drive and the Great America Parkway. The Levi's Stadium is a professional, 68,500 seat multi-function stadium which is visible from the Tower. The stadium holds professional football games which are more brightly lit, and non-professional football games, which are not as brightly lit. During the site visit and light measurements of the Levi's Stadium on October 10, a non-professional football game was being held, so the stadium was not at its brightest light level. Other potential activities could include show, stadium concerts, and other large scale community events.

From the view of the Airport Control Tower, the Levi's Stadium's LED digital scoreboard and high output stadium lights are clearly visible. While the Levi's stadium is 3.5 miles away, the approximate elevations are similar to the Tower's observation floor. Coincidentally, a large digital screen is aimed directly at the Tower and is visible through an architectural gap in the stadium seating bowl. According to several air traffic controllers, the greatest visual hazard is when the stadium runs tests of their scoreboard, when the color saturation and intensity is displayed at full brightness. When the stadium runs its tests, they run solid screens of different colors that alternate (Instant change or flash) from full white screen, to full red screen, to full yellow screen, etc. The combination of the color saturated intensity and the flashing effects cause significant visual issues for the air traffic controllers. A recent event at a professional night game (in October 2014) also caused visual issues for the air traffic controllers. This time it included the flashing and alternating images of "GET", followed by "LOUD".

Another brightness issue is when the Levi's stadium does a fireworks show. The FAA regulates the maximum height at which the fireworks can reach, limiting it to 300 feet above ground level. This still makes the fireworks visible from the Airport Control Tower, and from pilots entering and leaving the airport. The intensity of the fireworks and the varying colors that are displayed would appear that much brighter as they happen at night, and the rest of the visual field is that much darker for workers at the airport that it is much more of a distraction when working.

In order to measure diversity, brightness, and lighting issues near the airport, Lighting Design Alliance staff randomly toured the adjacent neighborhoods during both daytime and nighttime, looking for potential lighting issues and reference signage and lighting applications. All measurements were documented on October 10, 2014, with clear weather and recorded sunset at 8:00 PM. Measurements were taken from Raymond Street and Duane Avenue to evaluate an existing programmable electronic sign off U.S. 101 using a luminance meter, which measures in candelas per square meter (cd/m^2) or Nits. Readings were taken from two different levels, for the different potential views of the signage. One view is from ground level which is the viewpoint of the pedestrian and automobile traffic, and the second view is from within the Airport Control Tower looking downwards towards the sign, which would have a viewing angle of less than 1° off axis to the sign. Note that the measurements were taken using a specific date and time and used a specific luminance meter. A different luminance meter may have a margin of error of +/- 5% difference and as images on static and digital signage are updated. Those different images produce different readings. While distance does not affect brightness (as measured in cd/m^2 or nits), where the viewing angle and the specific target can impact reading, so readings may vary. Locations where measurements were made are shown on Figure 3.5-1 and are described below.

Figure 3.5-1: SITE MAP REFERENCE



At the Air Control Tower, a luminance reading was taken for each brightness source while in the Tower (which had tinted windows) and another reading was taken outside of the Tower on the catwalk with no obstruction of light. The tinted windows inside of the Airport Control Tower block around 50% of the brightness of the outside luminance.

Prior to completion of documentation of existing lighting conditions, the national and local FAA staff were contacted to inquire if they had any further review parameters or regulations to be included in the review, but further information was not received.

1 –Buckshaw Stadium (El Camino Real and Accolti Way):

The existing stadium is in direct view from the Airport Control Tower, which is a collegiate sports lighting application off to the southwest of the Tower. These fixtures were not brought up by the air traffic controllers as a current visual hazard, as the fixtures on the field have been carefully aimed and provided with glare shields so that there is no reported issues of glare from the fixtures as viewed from the Tower.

The brightest source of light coming from the Buckshaw Stadium was from the Stadium lights, which were turned on during the night of the lighting survey. From our view inside the Tower, the luminance reading of the sports lighting was 104 cd/m² (nits²). From outside of the Tower, the luminance reading of the sports lighting was 154 cd/m² (nits).

See Figure 3.5-1 for location in relationship to site and Airport Control Tower.
See Appendix B1 for site photo and luminance readings.

² The standard international (SI) unit of measurement for luminance is candelas per meter squared (cd/m²). The non-SI term for the same unit is the “nit”. (Section 12.18 of the IESNA (Illuminating Engineering Society of North America) Lighting Handbook). When addressing lighting standards under the

Figure 3.5-2: BUCKSHAW STADIUM LIGHTING – VIEW INSIDE AIRPORT CONTROL TOWER – AT NIGHT



Figure 3.5-3: BUCKSHAW STADIUM LIGHTING – VIEW OUTSIDE AIRPORT CONTROL TOWER – AT NIGHT



2 – Airport Lighting:

The most visible site to the Airport Control Tower is the actual San Jose International Airport facility itself, which is directly across the way and in plain sight. The Tower staff had no visual hazard complaints for the Airport site or flood lighting. The Airport lighting comprising of white and blue floodlights on the building facades, blue marker lighting on the runways, and tall pole mounted apron lights around the landing field, aimed back towards the Tower. The brightest lights recorded were the pole mounted floodlights at the northeast end of the runway.

The most visible lighting coming from the Airport was the white and blue floodlighting on the passenger terminals, as it takes up the most visible space. From our view outside the Tower, the luminance reading of the white flood lighting was 14.5 cd/m² (nits). From inside of the Tower, the luminance reading of the blue floodlighting was 8.2 cd/m² (nits).

The brightest source of light coming from the Airport was from the pole mounted lights, which were turned on during the night of the survey. From the view inside the Tower, the luminance reading of the pole lighting was 63 cd/m² (nits). From outside of the Tower, the luminance reading of the sports lighting was 72 cd/m² (nits).

See Figure 3.5-1 for location in relationship to site and Airport Control Tower.
See Appendix B2 for site photo and luminance readings

Figure 3.5-4: AIRPORT FLOOD LIGHTING – VIEW INSIDE AIRPORT CONTROL TO-ER - AT NIGHT



Figure 3.5-5: AIRPORT FLOOD LIGHTING – VIEW OUTSIDE AIRPORT CONTROL TO-ER - AT NIGHT



Figure 3.5-6: AIRPORT POLE LIGHTING – VIEW INSIDE AIRPORT CONTROL TO-ER - AT NIGHT

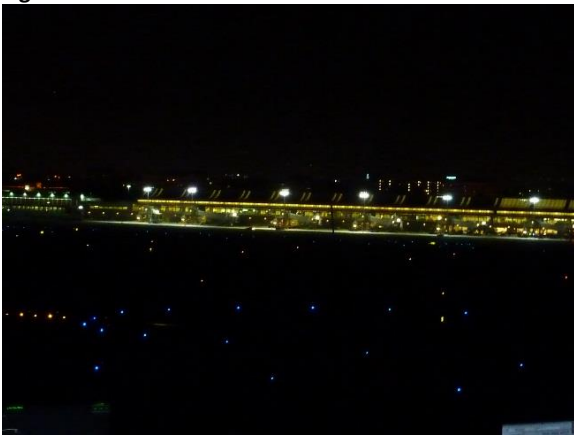


Figure 3.5-7: AIRPORT POLE LIGHTING – VIEW OUTSIDE AIRPORT CONTROL TO-ER - AT NIGHT



3-Casino M8trix (Matrix Boulevard and Airport Parkway):

Behind the Airport facility is the M8tix Casino which has its building crown visible from the Airport Control Tower. The crown lighting has a combination of backlit box-letter signage, exposed LED box-letter signage, and color changing RGB LED floodlighting. At night, the most visual lighting element of this façade is the exposed LED box-letter signage, but the workers at the Airport Control Tower have not listed the casino as a visual deterrent.

From the view inside the Tower, the luminance reading of the color changing flood lighting was 1.01 cd/m² (nits). From outside of the Tower, the luminance reading of the color changing flood lighting was 1.06 cd/m² (nits). From outside of the Tower the luminance reading of the exposed red LED points of light on the “M” portion of the signage was 190.5 cd/m² (nits). From outside of the Tower the backlit LED box-letter signage was 265.90 cd/m² (nits).

See Figure 3.5.1 for location in relationship to site and Airport Control Tower.

See Appendix B3 for site photo and luminance readings

Figure 3.5-8: M8TRIX CASINO CROWN LIGHTING – VIEW INSIDE AIRPORT CONTROL TO–ER - AT NIGHT



Figure 3.5-9: M8TRIX CASINO CROWN LIGHTING – VIEW OUTSIDE AIRPORT CONTROL TO–ER - AT NIGHT



4 - SOS Steel (Lafayette Street and Richard Avenue):

One of the brighter visual objects was an exposed neon illuminated sign for the SOS Steel Company. This sign was farther away from both the airport and 101 Tech site, and is slightly off axis and it was not brought up as a visual deterrent for the workers at the Airport Control Tower.

From the view inside the Tower, the luminance reading of the red exposed neon sign lighting was 3.0 cd/m² (nits). From outside of the Tower, the luminance reading of the red exposed neon sign lighting was 5.7 cd/m² (nits).

See Figure 3.5-1 for location in relationship to site and Airport Control Tower.

See Appendix B4 for site photo and luminance readings

Figure 3.5-10: SOS STEEL SIGN LIGHTING – VIEW INSIDE AIRPORT CONTROL TOWER - AT NIGHT



Figure 3.5-11: SOS STEEL SIGN LIGHTING – CLOSE-UP VIEW OF SIGNAGE DURING DAY



5 - Adjacent warehouse floodlighting:

The brightest source recorded was from wall mounted floodlights on warehouses right next to the Airport Control Tower. These were not brought up as a distraction as they are mounted at a lower level and do not come up in the worker's line of sight.

From the view inside the Tower, the luminance reading of the wallpack flood lighting was 257 cd/m² (nits). From outside of the Tower, the luminance reading of the wallpack flood lighting was 379 cd/m² (nits).

See Figure 3.5-1 for location in relationship to site and Airport Control Tower.
See Appendix B5 for site photo and luminance readings

Figure 3.5-12: WAREHOUSE FLOOD LIGHTING – VIEW OUTSIDE AIRPORT CONTROL TOWER - AT NIGHT



6 - Adjacent Street Lighting:

The existing street lights on streets adjacent to the Tower side of the Airport are a combination of Low-pressure Sodium and dropped lensed Cobra Heads with metal halide lamps. Many of the street lights are physically blocked from view, either by the Airport terminals, hangers, adjacent building and even vegetation. No air traffic controllers identified the street lighting as an issue.

See Figure 3.5-1 for location in relationship to site and Airport Control Tower.

7 - Levi's Stadium:

To the northwest of the Airport Control Tower, the Levi's Stadium is visible. The brightest source of light was from the LED digital billboard. Because the signage was on an angle in comparison to the Airport Control Tower, the full brightness coming from the billboard could not be surveyed.

From the view inside the Tower, the luminance reading of the digital display signage was 17.3 cd/m² (nits). From outside of the Tower, the luminance reading of the digital display signage was between 20 cd/m² (nits) and 67 cd/m² (nits) as the brightness varied depending on what was displayed

See Appendix B7 for site photo and luminance readings

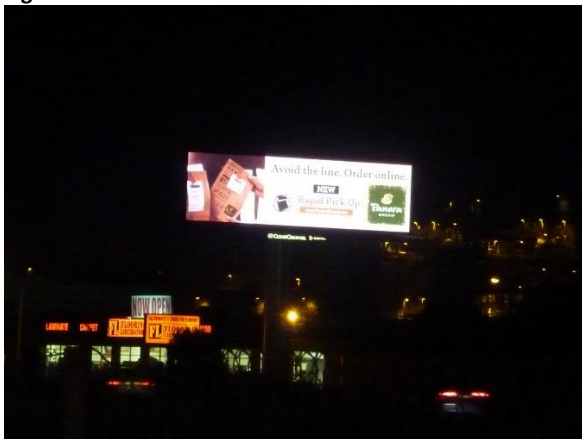
Figure 3.5-13: LEVIS STADIUM DIGITAL DISPLAY SIGNAGE – VIEW OUTSIDE AIRPORT CONTROL TOWER - AT NIGHT



Digital Display Signage (Red, Green, and Blue LED):

From the readings of the digital display signage taken from Raymond Street and Duane Avenue to the sign location across the 101 highway, the brightness of the existing digital display signage in the area measured between 20-140 cd/m². The brightness of the sign depends on the images on digital signage and colors produced by varying the LED intensities. As the images change, different images produce different readings. White displays will provide more brightness than a color display such as a red or blue. In the survey, the brightest reading of each sign was taken, and the color was documented at the time of the reading. See Appendix 1.C for additional data and images.

Figure 3.5-14: EXAMPLE OF DIGITAL DISPLAY SIGNAGE ADJACENT TO U.S. 101, NEAR RAYMOND STREET AND DUANE AVENUE



3.5.1 101 Tech Site

Under existing conditions there is no lighting on the vacant 101 Tech Office/R&D site. Portions of the site closest to the Trimble Road off-ramp may be illuminated at night by vehicle passerbys. There could also be the potential construction work performed at night on the job site, which could include temporary work lights. This is all hypothetical, and pending the agreement between the 101 Tech developers and the city. Once the site is built, there will be parking lot lighting, façade lighting, and site lighting, but as none of it has been installed, it cannot be included in this documentation for how it would affect the ambient light levels.

3.5.2 Adjacent Guadalupe River Trail

A segment of the Guadalupe River Trail extends along the southern bank of the river and under the U.S. 101 bridge overcrossing. Night lighting of the trail is not present at this location and is not planned.

3.6 Review Parameters

General:

Due to its geographic location, operation of the proposed freeway sign could affect several types of activities or land uses. The first effect would be to motorists as the Programmable Electronic Freeway Sign will be visible from motorists traveling northbound and southbound on U.S. 101. The second effect would be to the Airport Control Tower. The third effect would be towards incoming and departing aircraft. The final effect would be towards the adjacent Guadalupe River corridor and trail that the U.S. 101 freeway passes over.

The evaluation below is limited to the environmental effects of the proposed freeway sign at the 101 Tech site. The addition or introduction of a dynamic, LED sign complicates the evaluation process in that the brightness and display are not fixed. The LEDs do possess the capability to dim, which is a huge asset, but the media content that would be displayed on the sign is not known at this time. The cycle or timing of image transitions is critical and will be regulated to City and State of California standards, as the standards can vary slightly from industry recommendations. The final design of the signs or images that will be displayed will have a great impact on the illuminance levels and brightness levels generated by the sign. For example, an image of a white polar bear in a blizzard has the potential to be extremely bright, while a whale swimming in the ocean will be visibly lower. As the content is not known or fixed, mitigation measures are required to insure that the sign does not result in distractions or hazards to motorists, air traffic controllers in the Airport Control Tower, or pilots. For the Guadalupe River corridor, the potential for additional illuminance to effect biological resources is an environmental concern.

3.6.1 Roadway Impacts

This section presents the assumptions used in the analysis of the lighting impact of proposed digital signage to drivers on the adjacent freeway (U.S. 101 and ramps). There are four major factors that will affect the perception of the sign. These factors have been used as a basis for evaluating the potential impacts of the design proposal:

- Size and shape of the object
- Location of the object in the field of view
- Stationary vs. Moving: If the object is moving, the direction of movement of the object relative to the driver's direction of travel becomes critical. Stationary objects are more difficult to detect.
- Contrast between the object and its background.

The site measurements and observations support the following analysis of the lighting data:

a. Size

For the Programmable Electronic Freeway Sign, the physical orientation of the sign is perpendicular to the 101 highway, so that the sign elements will be visible to drivers traveling northbound and southbound on the highway. The City of San Jose has clearly defined size restrictions in their Sign Code. It states that no individual freeway sign shall have an area in excess of five hundred (500) square feet, each programmable electronic sign surface shall not exceed 375 square feet, and that no freeway sign shall exceed sixty feet in height above the surrounding grade.

b. Location

The location of the Programmable Electronic Freeway Sign is to the north of U.S. 101. The sign position is oriented so that the faces of the sign will be facing perpendicular to the highway, and visible to motorists. One side of the digital display sign will be facing towards drivers traveling northwest, and the other sign will be facing towards drivers traveling southeast. The approximate location of the sign is 110'-0" to the center of the Trimble Road Off-Ramp, and another 110'-0" from that point to the main lanes of the 101 Freeway. Because the sign element is mounted on the north side of the freeway, it will be more

visible to motorists traveling northbound on the freeway. The view of the sign element is partially obstructed when traveling northbound, as there is an overpass on the freeway that exists around 1,100 feet away from the sign. So this would limit the experience of the sign by drivers traveling northbound to only have a full view of the sign for the 1,100 feet. For motorists traveling southbound, there is no visual obstruction, but the southbound lanes are approximately 300-400 feet away from the signage, so their viewing angles of the brightness of the sign will be lesser than the viewing angles of the sign brightness from the northwest viewing.

As for the 101 Tech site's geographical location, the surrounding neighborhood is already at a darker level, consisting of an airport facility to the south, and industrial buildings. The 101 Tech site is not yet under construction, so the ambient light levels are dimmer than they will be once the 101 Tech site is built, as there will be site lighting, parking lot lighting, and building lighting that will contribute to a higher ambient light level. This impacts the brightness of the Programmable Electronic Freeway Sign as the City of San Jose's Sign Code regulates the brightness of the sign based on its added light to the ambient brightness in the area. Signs shall utilize automatic dimming technology to adjust the brightness of the sign relative to ambient light so that at no time shall a sign exceed a brightness level of three-tenths foot candles above ambient light, as measured using a foot candle (FC) meter and in conformance with the following process: A sign that is three hundred fifty-one to six hundred fifty square feet in area shall be measured at a distance of two hundred feet from the sign area being measured. An ambient light measurement shall be taken using a foot candle meter at some point between the period of time between thirty minutes past sunset and thirty minutes before sunrise with the sign turned off to a black screen. Immediately following the ambient light measurement taken in the manner required by this subsection, an operating sign light measurement shall be taken with the sign turned on to full white copy. The brightness of a sign conforms with the brightness requirements of this subsection if the difference between the ambient light measurement and the operating sign light measurement is three tenths foot candles or less. Because the ambient light level is not known at this point, it can be assumed that when dimmed to the 15%- 5% level at night, the digital display would not add any significant light or glare to the street.

c. Motion CRI-8 seconds and CRIII-12 hours

Rapid changes in images can be distracting to drivers, and it is recommended to limit the refresh time so that a typical driver will only experience one static image during typical drive time in the field of view. In terms of the images being stationary or moving, the intent of the proposed project is that the digital signage perpendicular to motorists will be a combination of still images which refresh as frequently as every eight seconds, per the current Sign Code as the signage element is located within 400 feet of a freeway travel lane. As such, the digital signage would not provide flashing image changes. In addition, by maintaining reduced brightness levels at night any distraction to drivers would be reduced. In accordance with IESNA Recommendations, when multiple digital display signs are visible to motorists, signs should change at the same time to limit driver distraction.

d. Contrast

The contrast of the object or hazard is a function of the luminance difference between the object and its background. The digital display should not be a source of distraction for a driver. A contrast ratio of less than 30:1 would not cause glare.

3.6.2 Airport Control Tower Impacts:

Illumination is hard to predict especially without a final sign design or media content. The evaluation included an intensive internet search, on-site analysis, interview of Air Traffic Controller staff, contacting of the FAA and the review of current IES (Illuminating Engineering Society) documentation. Lighting Design Alliance has similar experience with roof-top signs and airport evaluation of LED reader board signs. The historic experience with the Hollywood Park Casino, giant red neon sign on its roof, led to in depth discussions with the FAA and Los Angeles International Airport (LAX) officials. The result of the analysis is that pilots like visual landmarks, day and night, to help with orientation. The only concern is the actual brightness of the landmark cannot create glare.

The IES is known as the lighting authority and creates recommendations for proper illumination techniques. The IEC's 10th Edition handbook is over 3.5 inches thick and references airport illumination. Unfortunately, the references are typically for interiors or airport apron illumination, with no reference to glare, either to pilots or to the Air Traffic Control Tower. The IES also has a special Aviation committee and they are revising the Recommended Practice RP-37, which is currently outdated and cannot be referenced.

While we referenced historic contact with the FAA, we have recently contacted the San Francisco Airports District Office (ADO) of the FAA, as well as FAA headquarters in Washington. At this point we have no new updates from either of them.

In the analysis, was viewed at night and multiple conversations occurred with the air traffic controllers. The only current visual issue that they identified was the LED reader board in the Levi's Stadium, which was documented earlier in this report.

Through careful analysis, measures have been identified to ensure that the new signage will not create a new, significant impact to the controllers or approaching pilots.

3.6.3 Aircraft Evaluation Parameters:

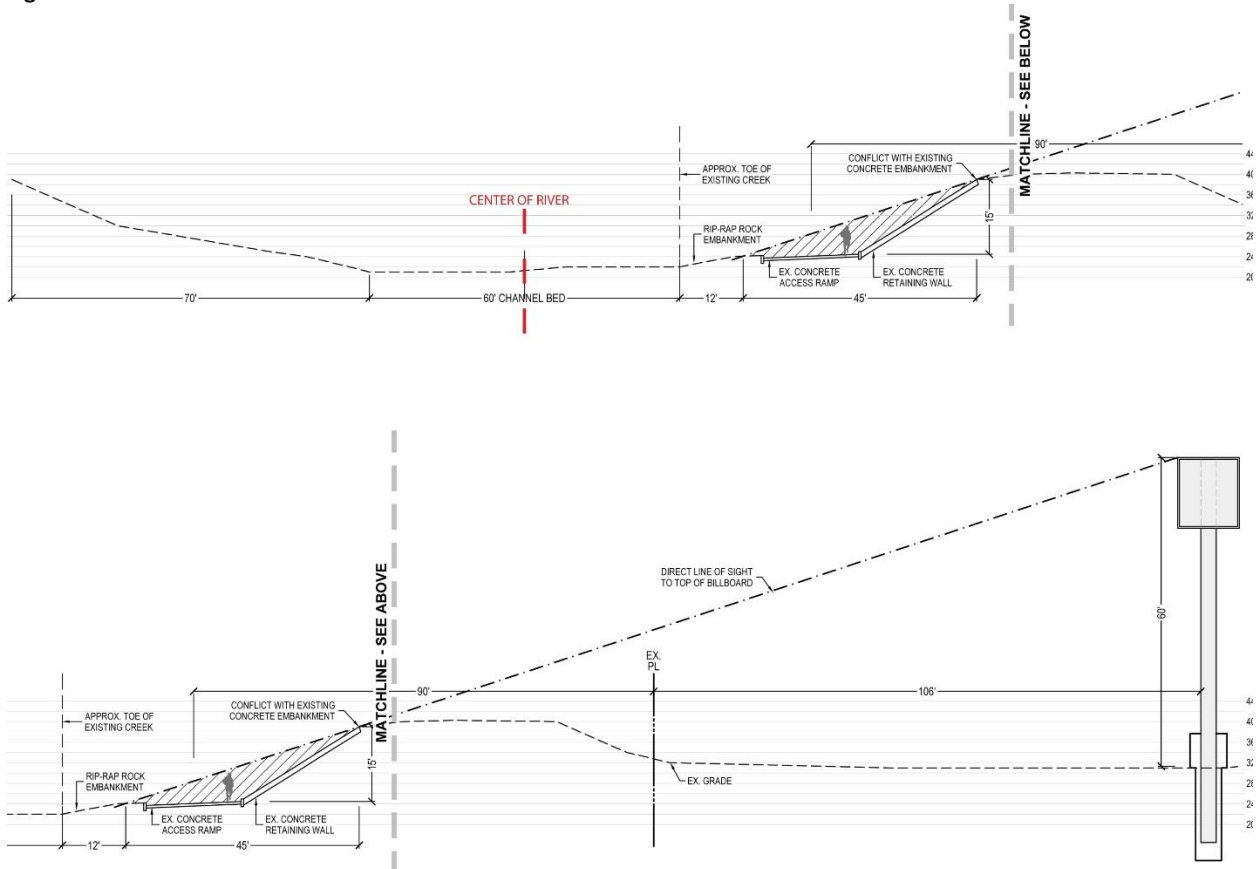
The analysis was focused on the main orientation of the runways. While there is a predominant wind condition, aircraft can and do land in both orientations. We have had no direct contact with airborne pilots as a part of this evaluation. It is our belief, however, that landing pilots could have a greater sensitivity to glare issues as they have had longer periods of adaptation and they will have a longer view corridor in which the signs could be visible. Departing pilots are close to the signs and as they take off, the orientation of the aircraft could further block their view of the signs.

Because the sign's location is above the pedestrian level, the potential viewing angles of the sign could impact some of the aircraft landing, departing, and taxiing, depending on their approach into the airport. The orientation of aircraft at the Airport is dependent on the prevailing winds. When winds are from the northwest, aircraft land to the northwest on Runways 30L and 30R. When winds are out of the southeast, aircraft land to the southeast on Runways 12L and 12R. For the western approach, aircraft land on Runways 12L and 12R, which will have an unobstructed view of the signage element, but will not have a direct viewing angle of the main brightness of the sign. For the Eastern approach to Runways 30L and 30R, the views of the signage will be potentially blocked by the Airport Terminal Building, depending on the location of the plane, as the building is approximately 62'-0" above grade.

3.6.4 Guadalupe River Evaluation Parameters:

To the northwest of the Programmable Electronic Freeway Sign, is the Guadalupe River, which travels underneath the U.S. 101 bridge overcrossing. The river flows northward for 14 miles from Guadalupe Creek downstream of Coleman Road in San José to San Francisco Bay. The Programmable Electronic Freeway Sign is located approximately 250 feet away from the center of the channel bed of the Guadalupe River. The height of the center point of the sign is approximately 70 feet above the grade of the channel bed, as there is a 15 foot high levee and retaining wall approximately 87 feet away from the center of the channel bed. See Figure 3.6-1 for relationship of signage to the Guadalupe River and elevation of sign in comparison to the channel bed.

Figure 3.6-1: SIGNAGE EXHIBIT



3.6.5 Energy/Title 24 Impacts:

Title 24 of the California Code of Regulations limits energy use for exterior signage in California. Title-24 2008 limits exterior, internally illuminated signs, and integral electronic displays to 12 watts/sq. ft.

Title 24 Wattage limits affecting exterior internally illuminated signs and integral electronic displays				
	Watt/sq. ft at full white	Brightness at Full White (candelas/sq. meters)	Hours on per day	Total watt-hours per day per sq. ft. of sign
Daytime Usage (7am to 7pm)	12	3500*	12	144
Nighttime Usage (7pm to 7am)	5	1500*	7	35
Total watt-hours per day per sq. ft. of sign				179

*Title 24 only restricts energy usage and does not restrict brightness

For Title 24 compliance, outdoor sign lighting shall meet the following requirements as applicable:

- All outdoor sign lighting shall be controlled with a photocontrol in addition to an automatic time-switch control, or an astronomical time-switch control.
- All outdoor sign lighting that is ON both day and night shall be controlled with a dimmer that provides the ability to automatically reduce sign lighting power by a minimum of 65 percent during nighttime hours. Signs that are illuminated at night and for more than 1 hour during daylight hours shall be considered ON both day and night.

3.7 Evaluation of Proposed Signage

Per Lighting Design Alliance’s documentation, we have provided the following evaluation of the Programmable Electronic Freeway Sign, and what perceived impact it will have on the following areas: drivers on the U.S. 101 roadway, aircraft controllers in the Airport Control Tower, Aircraft Pilots, the Guadalupe River corridor, and Energy/Title 24.

3.7.1 Impact to Drivers on U.S. 101: Illuminance

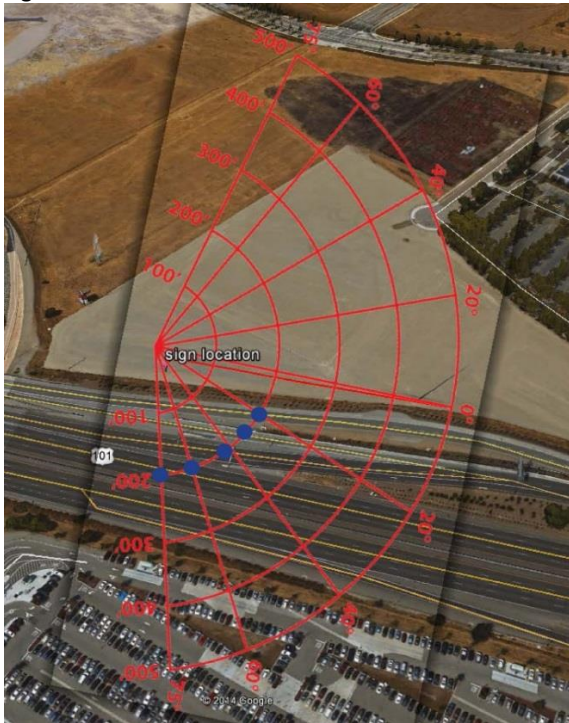
As previously described, illuminance is the areal density of the luminous flux incident at a point on a surface. The unit of illumination is the footcandle. Standards for driver safety is addressed by the City and State using the footcandle. Lighting is, therefore, described in terms of illuminance and associated footcandles in the discussion below.

The location of the Programmable Electronic Freeway Sign is to the north of U.S. 101. The sign position is oriented so that the faces of the sign will be facing perpendicular to the highway, and visible to motorists. One side of the digital display sign will be facing towards drivers traveling northwest, and the other sign will be facing towards drivers traveling southeast. The main view of the sign will be from motorists traveling northwest, with the sign only really visible from 1,100 feet away as a portion of the view will be blocked by the State Route (SR) 87 overpass ahead.

The manufacturer of the sign element that will be installed onsite, Watchfire Signs, has provided a photometric report of the delivered footcandles on the highway with a sign brightness of 300 Nits or cd/m². This photometric report shows the increase in light compared to the existing ambient light in the area. This report does not take into account any potential obstructions that could be in the future completed site, such as trees, as they would further reduce the lighting on the highway. Per the City of San Jose’s Sign Code, a sign that is three hundred fifty-one to six hundred fifty square feet in area shall be measured at a distance of two hundred feet from the sign area being measured. The brightness of a sign conforms with the brightness requirements of this subsection if the difference between the ambient light measurement and the operating sign light measurement is three tenths (0.3) footcandles or less. See Appendix A for the Watchfire Sign’s photometric documentation.

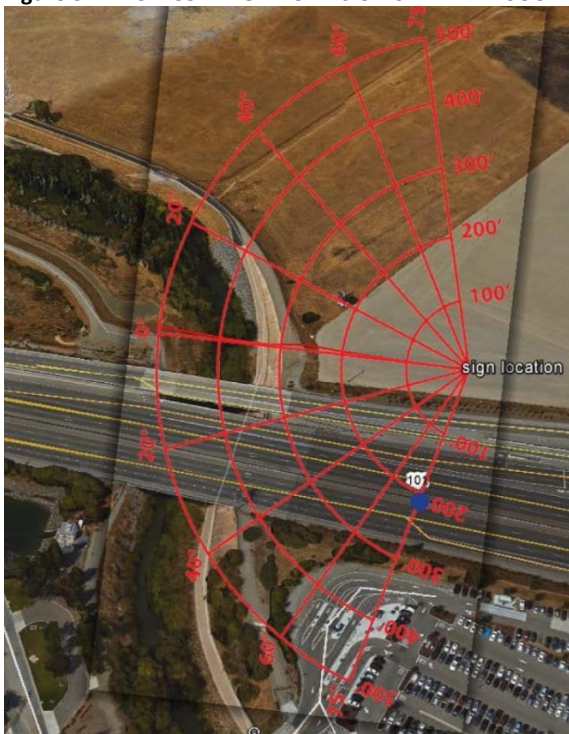
For the northwest approach, from the photometric report provided by Watchfire Signs, the main distance away from the sign that we are measuring for brightness compliance is 200’-0” away from the signage. From 200’-0” away from the signage, the views of the signage element are at the onramp, and on the main lanes of the highway. For the onramp lane, at 200’-0” away from the signage, the calculated point is 20° off of the main directionality of the sign, providing an added illuminance of 0.0621FC above the ambient. For the next lane over, the calculated point is 30° off of the main directionality of the sign, providing an added illuminance of 0.052FC above the ambient. For the next lane over, the calculated point is 45° off of the main directionality of the sign, providing an added illuminance of 0.036FC above the ambient. For the main roadway, the calculated point is 60° and 75° off of the main directionality of the sign, providing an added illuminance of 0.0190FC and 0.0038FC respectively above the ambient. The only point where the driver will have a full direct view of the sign is on the onramp, but the point is farther away from the sign than the 200’-0” calculation point accounts for. See Figure 3.7-1 for reference. The projected added illuminance at 200 feet of the sign face for the northwest approach would be well below the 0.3 FC standard.

Figure 3.7-1: CALCULATION POINTS ON SITEMAP – NORTHWEST BOUND



For the southeast approach, from the photometric report provided by Watchfire Signs, the main distance away from the sign that we are measuring for brightness compliance is 200'-0" away from the signage. From 200'-0" away from the signage, there is only one calculation point that is approximately located in the main lanes of the highway. For the main roadway, the calculated point is 75° off of the main directionality of the sign, providing an added illuminance of 0.0038FC above the ambient. See Figure 3.7-2 for reference. The projected added illuminance at 200 feet of the sign face for the southeast approach would be well below the 0.3FC standard.

Figure 3.7-2: CALCULATION POINTS ON SITEMAP – SOUTHEAST BOUND



3.7.2 Impact to Drivers on U.S. 101: Luminance (Brightness)

When talking about luminance of the signs, we are measuring the brightness of the signs from a certain angle both in the horizontal plane and the vertical plane in relation to the sign element. As luminance or brightness does not change over the distance the object is away, the varying element is the area of the surface that you see.

As far as the view from the cars, there is no direct, straight-on, view of the sign on the main driving lane going northbound or southbound. From the northbound direction (northwest approach), there is a view of the signage that is approximately 5° off axis, but this point is further than 500'-0" away from the signage element. For the rest of the views from cars traveling northbound, the signage ranges from 30° to 80° off axis in the main highway lanes, but this is dependent on which lane the driver is in, and how close their car is to the sign element. So for the onramp lane furthest north that has the most direct view of the signage, the highest brightness reading will be 300 Nits on the horizontal plane. This brightness level remains consistent until about 40° off axis where it starts to decline. At the farthest lane, especially when the driver is closer to the sign element, the readings drop off to 250 Nits to 175 Nits depending on the angle.

3.7.3 Impact to Drivers on U.S. 101: Conclusions

Motorists will have the most views of the signage, as the signs are oriented to be viewed by motorists traveling northwest and southeast. There are very limited direct views of the signage, and the sign is most visible for motorists traveling northwest. It will be up to the signage manufacturer to comply with the steps laid out in the City of San Jose Sign Ordinance for testing ambient light levels and setting dimming levels on the digital display signage onsite.

3.7.4 Impact to Airport Control Tower: Luminance (Brightness)

As previously described, luminance is a photometric measure of the luminous intensity of a surface. The luminance indicates how much luminous power will be detected by an eye looking at the surface from a particular angle of view. It is an indicator of how bright the surface will appear. The standard international (SI) unit of measurement for luminance is candelas per meter squared (cd/m^2). The non-SI term for the same unit is the "nit". (Section 12.18 of the IESNA (Illuminating Engineering Society of North America) Lighting Handbook). Lighting effects for airport safety is addressed using the nit. Lighting is, therefore, described in terms of luminance (brightness) and associated nits in the discussion below.

In relation to the Airport Control Tower, the signage element is installed roughly 1.1 miles away from the tower. The center of the sign is approximately 53.5 feet above ground level, and the viewing height on the Air Traffic Control Tower Observation deck is approximately 89 feet above ground level. The main concern for the tower would be the brightness of the sign, but because of the orientation of the sign, the tower will not be in direct view of the main brightness of the sign. All of these off axis values are based upon the proposed night maximum brightness of 250 Nits at the sign face. The Illuminating Engineering Society (IESNA) recommends a minimum brightness of 300 Nits which we have based the calculations off of. The Tower is located 80 degrees off axis of the main brightness of the screen. According to the proposed manufacturer, Watchfire, the maximum brightness to the Tower in a horizontal orientation would be 150 Nits or cd/m^2 . The center line of the Reader Board signage is 36'-0" feet below the Tower viewing platform for a differential angle of less than 1 degree above horizontal. According to the proposed manufacturer, Watchfire, the maximum brightness to the Tower in a vertical orientation would be 300 Nits or cd/m^2 .

3.7.5 Impact to Airport Control Tower: Conclusions

When compared to other lighted elements around the Tower as seen from the interior of the Tower, the LED digital display signage would not be the brightest object in view and would have more systems in place to control the brightness than other lit objects around the site. Therefore, the brightness of the proposed Programmable Electronic Freeway Sign is not anticipated to adversely affect operations at the Airport Control Tower as the tower has such a limited view of the sign, and will not have the views of the main brightness of the sign.

3.7.6 Impact to Aircraft: Luminance (Brightness)

For aircraft landing to the southeast on Runways 12L and 12R, the landing approach is variable. The runways are located where the sign would be partially visible, and are only off by approximately 30 degrees perpendicular to the face of the sign. For landing strip 12L, on a long distance approach, the aircraft are 35 degrees off axis and at the maximum touchdown location. For landing strip 12R, on a long distance approach, the aircraft are 28 degrees off axis and at the maximum touchdown location. According to the proposed manufacturer, Watchfire, the maximum brightness to the pilots in a horizontal orientation is 290 Nits or cd/m^2 . The height of the aircrafts vary as they approach the runway, so the maximum brightness to the pilots in a vertical orientation would be 175 Nits or cd/m^2 . To be conservative, we will use the maximum brightness as it would be the determining factor. For comparison, other lighted elements around the Airport, or regional freeway digital signs have a brightness range between 20 and 290 Nits or cd/m^2 (these luminance readings vary on the color of light that was documented).

Likewise, for aircraft landing to the northwest on Runways 30L and 30R, the landing approach is variable. The runways are located where the signs would be partially visible, and are only off by approximately 50 degrees perpendicular to the face of the sign. The Airport Terminal Building will block many of the views of planes that have landed. But for planes in the air, there would still be viewing angles of the sign, but would depend on the distance away from the sign, and the height of the plane in the air. For landing strip 30L, on a long distance approach, the aircraft are 40 degrees off axis and at the maximum touchdown location. For landing strip 30R, on a long distance approach, the aircraft are 45 degrees off axis and at the maximum touchdown location. According to the proposed manufacturer, Watchfire, the maximum brightness to the pilots in a horizontal orientation is 290 Nits or cd/m^2 . The height of the aircrafts vary as they approach the runway, so the maximum brightness to the pilots in a vertical orientation would be 150 Nits or cd/m^2 . To be conservative, we will use the maximum brightness as it would be the determining factor.

3.7.7 Impact to Aircraft: Conclusions

When compared to other lighted elements around the San Jose Airport site, the brightness from the display face would have comparable brightness and less brightness depending on the element. See Appendix B. The effects of the brightness on pilots is very dependent on the direction that they are flying into the airport, as well as the height they are above the ground. In the air, they will have less view angles than motorists. The sign will be visible from the air, but there are other illuminated elements in the pilot's view that at an equal or greater intensity than the 101 Tech display sign, that it will not add to light hazards for pilots. Once landed, many views of the signage will be blocked by the Airport Terminal building itself and the sign will not cause any negative impacts.

3.7.8 Impact to Guadalupe River: Illuminance

The Programmable Electronic Freeway Sign is located approximately 250 feet away from the Guadalupe River channel bed. The height of the center point of the sign is approximately 70 feet above the grade of the channel bed, as there is a 15 foot high retaining wall and levee approximately 87 feet away from the center of the channel bed. Based on the photometric documentation provided by the manufacturer, the added illuminance from the signage to the Guadalupe will be approximately 0.0521FC at the center of the channel bed. At approximately 160'-0" away from the sign, which is the beginning edge of the concrete retaining wall, the sign will add 0.0987FC. At approximately 280'-0" away from the sign, which is the outer edge of the creek bed, the sign will add 0.0411FC at the given point. At approximately 330'-0" away from the sign, which is the upper hill of the creek, the sign add 0.0299FC at the given point.

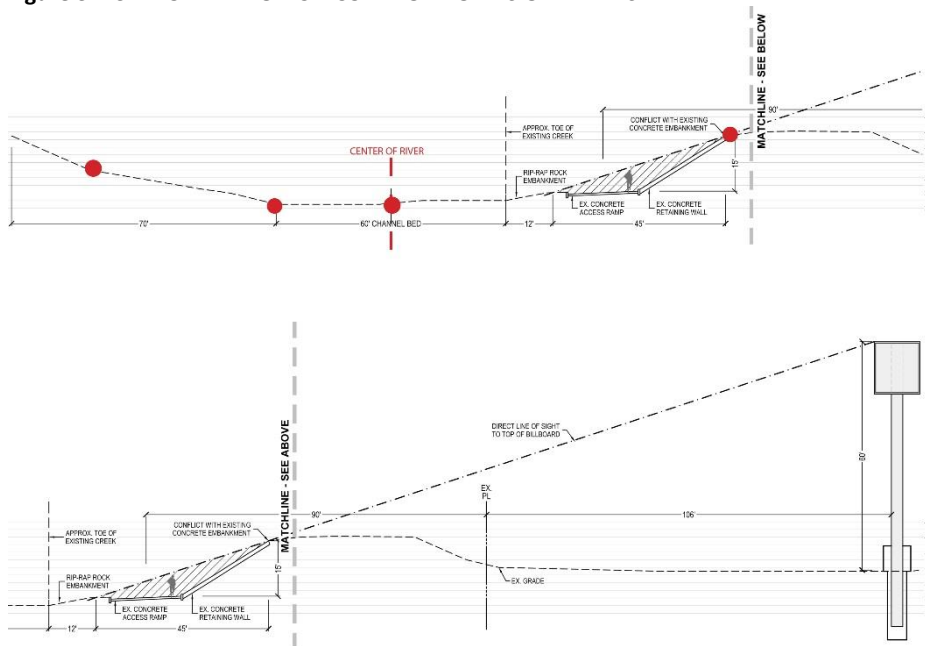
3.7.9 Impact to Guadalupe River: Conclusions

There are many charts found online from different engineering and light survey sources that list a range of typical illuminance levels for different occurrences in the sky, such as how much light is added by sunlight and moonlight. These ranges are to give a general idea of illuminance, as the sources do not list any specifics about their survey, as cloud coverage, weather, time of day, will all play a factor in the actual illuminance reading. The light levels that the sign are adding to the ambient light levels in the area are very minimal, and are well under the City of San Jose's Sign Ordinance required light levels. The light being added by the signage is at such a low level, it will be at a change undetectable to the human eye. See Figure 3.7-3 for comparative illuminance. See Figure 3.7-4 for the points onsite that were calculated for illuminance.

Figure 3.7-3: COMPARATIVE ILLUMINATION

Condition	Illumination (<i>ftcd</i>)
Sunlight	10,000
Full Daylight	1,000
Overcast Day	100
Very Dark Day	10
Twilight	1
Deep Twilight	.1
Full Moon	.01 - .03
Quarter Moon	.001
Starlight	.0001
Overcast Night	.00001

Figure 3.7-3: ILLUMINATION CALCULATION POINTS ON RIVER SITE



3.7.10 Impact to Energy Usage:

The proposed sign must meet California's energy code (Title 24 of the California Code of Regulations). This will be a requirement of the project and could limit the maximum daytime brightness of the sign, but will not have an impact on the night-time evaluation. With implementation of current codes, no significant impact on energy use is predicted. The signage is will incorporate all required photocell and dimming hardware to meet Title 24 code.

3.8 Project Mitigation Recommendations

Based upon the analysis and site survey, there are no issues with the signage and their brightness as long as the following conditions are provided in compliance with the City of San Jose's Sign Code.

Requirements on Signage Programing:

- Limit the Programmable Electronic Freeway Sign brightness to 300 nits (cd/m²) at nighttime, and 4,500 nits during daytime as these levels meet recommended standards based off of the IESNA which is the governing body of lighting standards for the industry. These brightness levels are only to be used as a temporary programmed level, as the signage must go through an onsite illuminance testing process, and as the final ambient light level cannot be determined, these light levels will be used as a temporary level, as the manufacturer has documented that they will be able to reach the City's code requirements with these levels calculated.
- Once the Programmable Electronic Freeway Sign is installed and operational on site, light measurements will be taken with a light meter aimed directly at the sign. All light measurements will be taken at 200 feet from the sign area being measured. A light measurement will be taken at some point between thirty minutes past sunset and thirty minutes before sunrise with the sign turned off to a black screen to determine what the true ambient light level is in the project vicinity. It is our recommendation to do this reading after all of the site lighting for the 101 Tech Office/R&D project is installed and operational as this will affect the ambient light levels. Another measurement shall be taken with the sign turned on to full white. The brightness of the sign will not contribute more than three-tenths footcandles above the ambient light level. Because the Programmable Electronic Freeway Sign is not installed yet, we cannot determine the exact level of brightness required to pass the regulation. The manufacturer has provided footcandle readings of the billboard that are in compliance, but there will still have to be an official site reading performed.
- Because of the site readings described above, the Programmable Electronic Freeway Sign will have a dimming system so that the signage brightness can be adjusted onsite.
- The Programmable Electronic Freeway Sign shall be equipped with sensors that modify the brightness of the sign in response to ambient lighting conditions and shall be required to occur gradually, to prevent a sudden change in perceptible brightness levels by pedestrians and motorists.
- Dim lights of the Programmable Electronic Freeway Sign slowly at dusk over a 45 minute fade rate, controlled by an astronomical time clock.
- The Programmable Electronic Freeway Sign shall not include large areas of reflective elements and have a contrast ratio of less than 30:1 to eliminate glare.
- The Programmable Electronic Freeway Sign will not display animated messages including flashing, blinking, fading, rolling, or any other effects that give the appearance of movement.
- The Programmable Electronic Freeway Sign will have an image refresh rate of eight seconds.
- The Programmable Electronic Freeway Sign will have a smooth transition rate
- The Programmable Electronic Freeway Sign will have a default mechanism that will cause the sign to revert immediately to a black screen in case of the sign malfunctioning.
- There will be a system in place to have the signage dimmed down in the event of fog by the project proponent providing a Ceilograph machine which is a mechanism that tracks cloud bases, and measures fog and can be tied into the dimming system of the signage elements to dim the light levels proportionally per the level of the fog.

Physical requirements of Signage:

- The Programmable Electronic Freeway Sign will not have a sign area in excess of 500 sf for each signage element and 375 sf for each programmable electronic sign face
- The Programmable Electronic Freeway Sign will not exceed 60 feet above the surrounding grade.
- The Programmable Electronic Freeway Sign will be located as close as possible to the freeway on the 101 Tech project site.
- The Programmable Electronic Freeway Sign may not exceed 75% of the total sign area and is integrated with the total sign, and will not exceed 375 sf in area for each programmable electronic sign.



December 9, 2014

Background on Optical Measurements and Calculations

Watchfire Signs has been in the LED sign business more than 17 years and before that in the incandescent light bulb sign business for more than 70 years.

Incandescent signs were commonly measured using illuminance measurements, partly because the light bulb is ideally a point source of light, illuminating equally in all directions, and illuminance meters are commonly available and inexpensive. Foot-candle measurements are made at a defined distance from the sign and the magnitude depends on the physical size of the sign.

LED signs are highly directional however, which is an advantage in an urban setting since the light can be directed more precisely to the intended audience. Luminance measurements have been used to specify LED signs by the industry. The candela per square meter (NITs) unit allows a specification that does not depend on size or viewing distance.

<http://www.signs.org/IndustryResources/TechnicalRegulatoryResources/BrightnessGuideforElectronicMessageCenters/tabid/745/Default.aspx>

The study done on the sign adjacent to a residential area used actual lab measurements made on modules using an illuminance meter. These measurements and extrapolations are then scaled up to the size of the sign and the distance corrections are made using the inverse square law. These calculations allow the study to be made in foot-candles, which then could be referenced back to the ISA study.

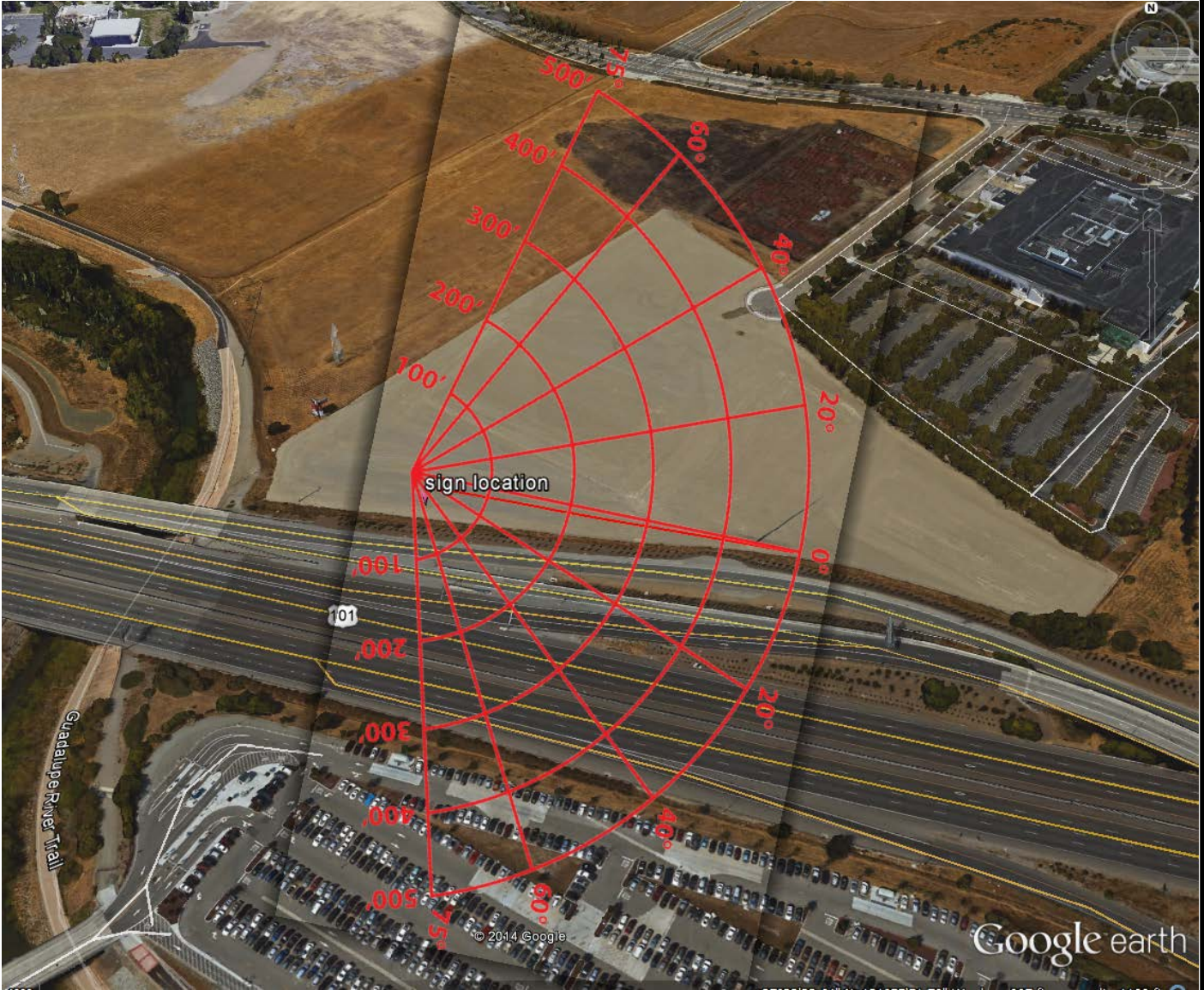
Below is a list of some of the measurement equipment used by Watchfire engineers. If there are any questions on this subject we would be happy to discuss them.

Equipment used by Watchfire engineers to make lighting measurements:

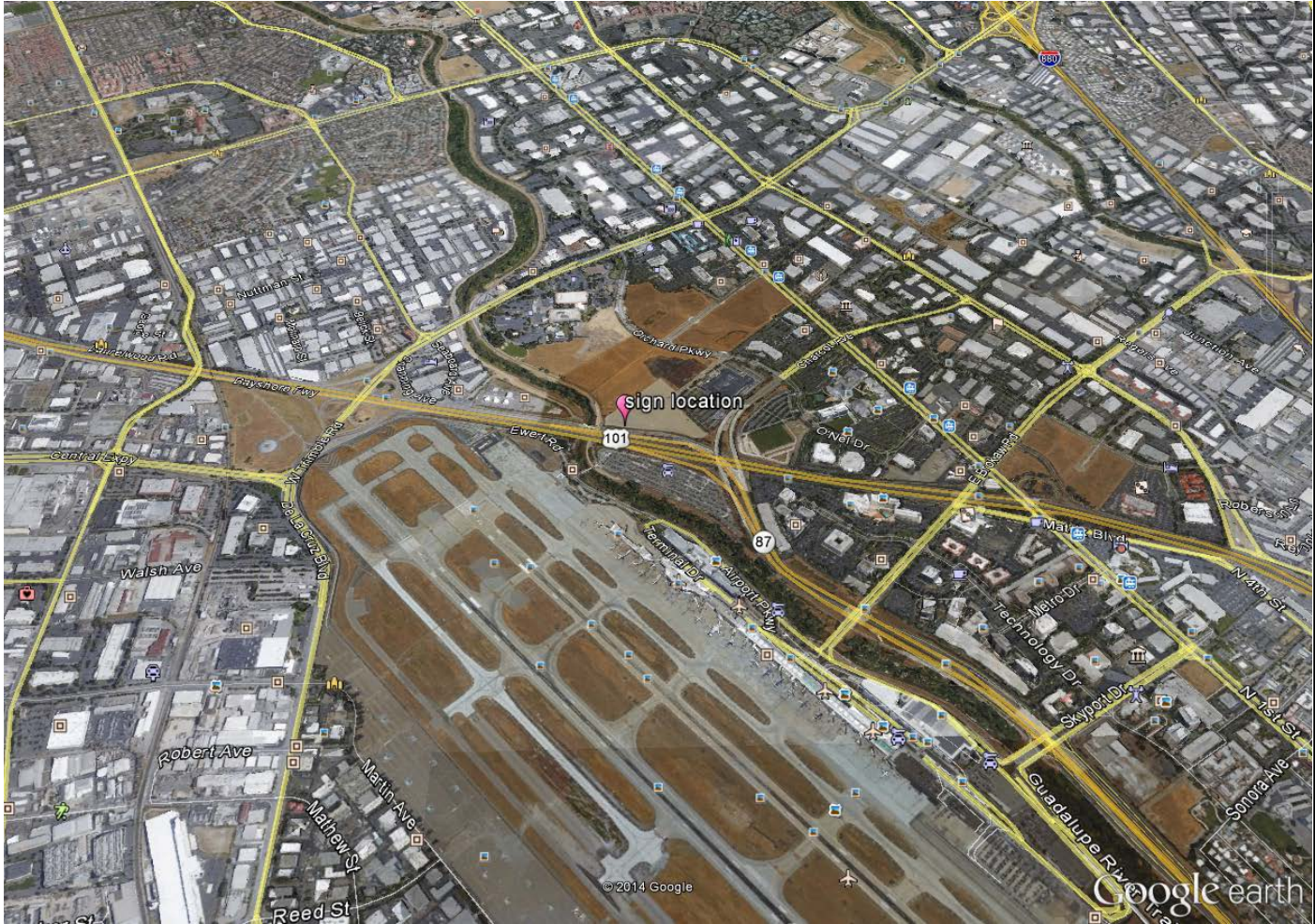
Foot-candles/Lux - Minolta Illuminance Meter T-10
NITs/candela/sq. m – Minolta Luminance Meter LS-100
Sign Calibration – Minolta CS-1000 Spectra radiometer

APPENDIX A: MANUFACTURER'S PHOTOMETRIC INFO

South East facing



Overview





December 9, 2014

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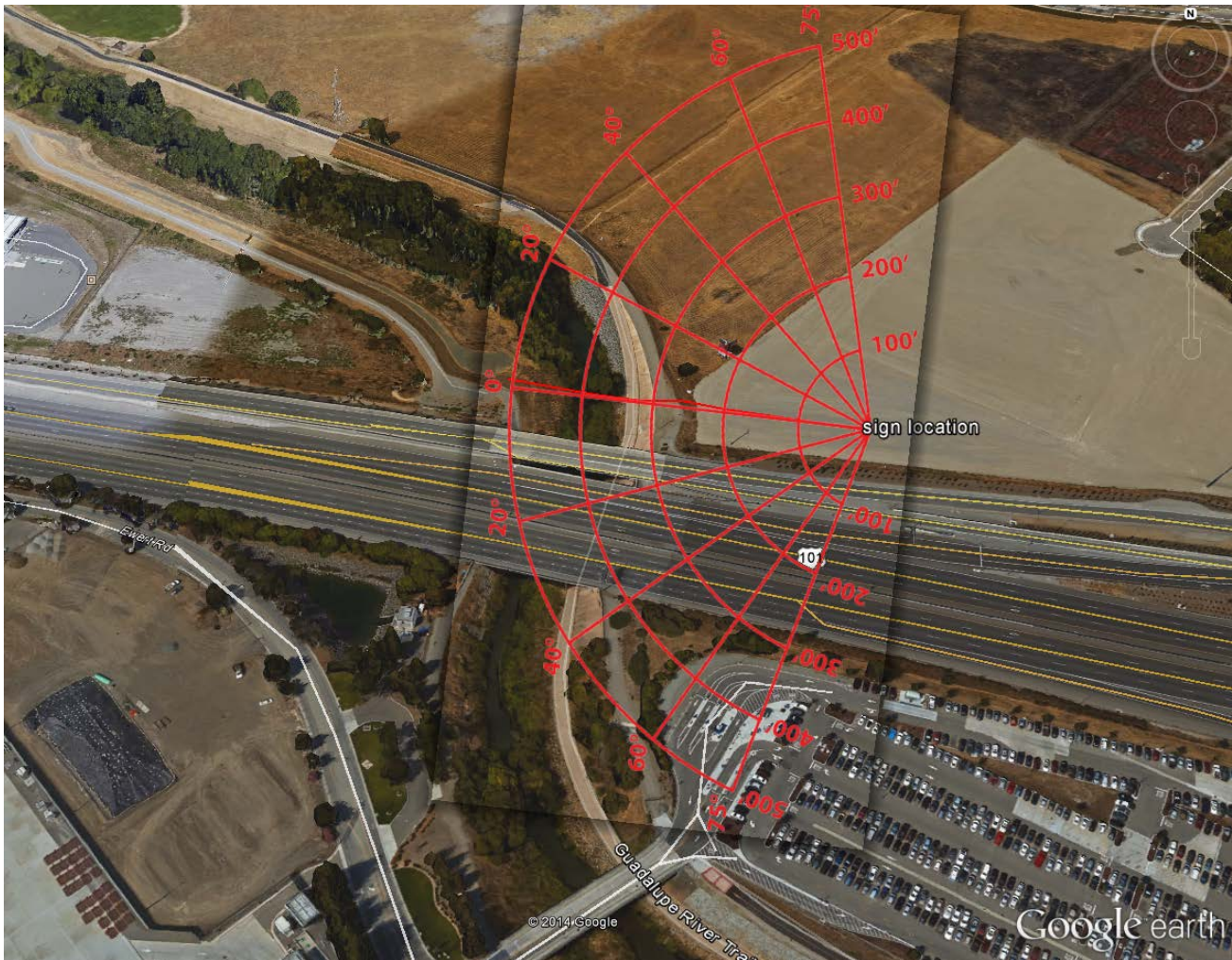
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Below is a list of some of the measurement equipment used by Watchfire engineers. If there are any questions on this subject we would be happy to discuss them.

Equipment used by Watchfire engineers to make lighting measurements:

Foot-candles/Lux - Minolta Illuminance Meter T-10
NITs/candela/sq. m – Minolta Luminance Meter LS-100
Sign Calibration – Minolta CS-1000 Spectra radiometer

North West Facing



Conclusion

Given the above comparisons and measurements, the home owners will see an almost undetectable difference in ambient light after installation of a billboard. Ambient light levels in the neighborhood are more heavily impacted by porch lights and landscape lights than the increases produced by a billboard.

Ray Digby
office 800-637-2645 x3006 Fax 217-442-1020
ray.digby@watchfiresigns.com

APPENDIX B: VISIBLE BRIGHTNESSES FROM TOWER

B1 - BUCKSHAW STADIUM - EL CAMINO REAL AND ACCOTI WAY



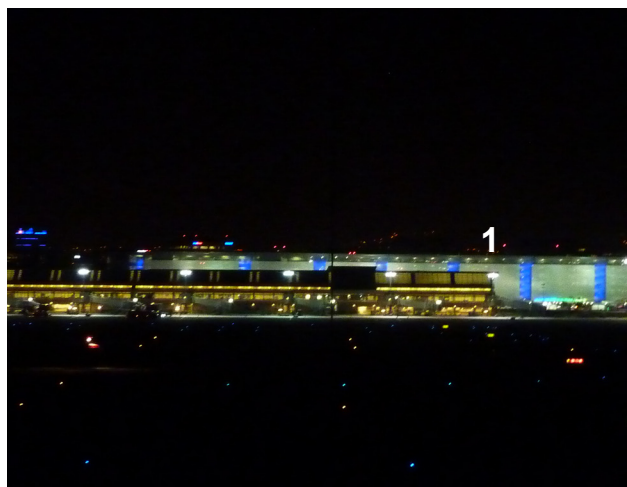
LUMINANCE RANGE:

1: STADIUM LIGHTS

-FROM INSIDE TOWER:
104 cd/m²

-FROM OUTSIDE TOWER:
154 cd/m²

B2 - AIRPORT LIGHTING - FLOODS



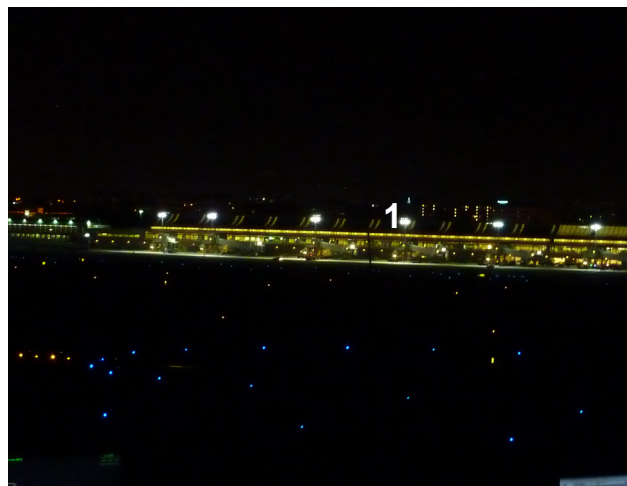
LUMINANCE RANGE:

1: AIRPORT FLOOD LIGHTS

-WHITE FLOODS OUTSIDE TOWER:
14.5cd/m²

-BLUE FLOODS OUTSIDE TOWER:
8.2cd/m²

B2 - AIRPORT LIGHTING - POLES



LUMINANCE RANGE:

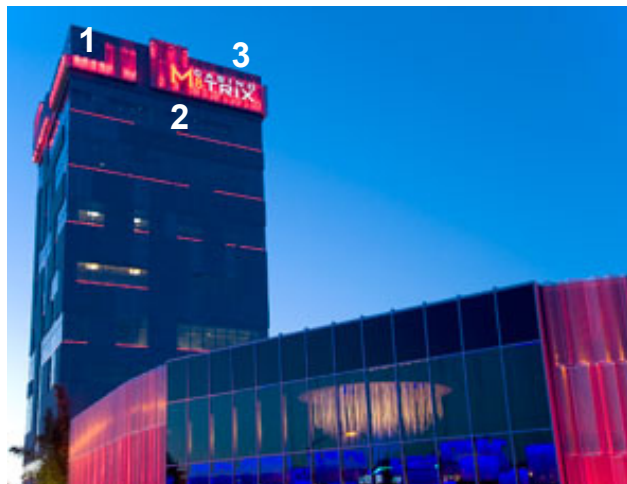
1: AIRPORT POLE LIGHTS

-FROM INSIDE TOWER:
63 cd/m²

-FROM OUTSIDE TOWER:
72 cd/m²

APPENDIX B: VISIBLE BRIGHTNESSES FROM TOWER

B3 - CASINO M8TRIX - MATRIX BLVD AND AIRPORT PARKWAY



LUMINANCE RANGE:

1: CASINO CROWN LIGHTS - 1.01cd/m²

2: CASINO M - 190.5cd/m²

3: CASINO BACK-LIT SIGNAGE - 265.9cd/m²

B4 - SOS STEEL - LAFAYETTE STREET AND RICHARD AVE



LUMINANCE RANGE:

1: SOS NEON LIGHTS

-FROM INSIDE TOWER:
3.0 cd/m²

-FROM OUTSIDE TOWER:
5.15 cd/m²

B5 - ADJACENT WAREHOUSE FLOODLIGHTING



LUMINANCE RANGE:

1: AIRPORT LIGHTS

-FROM INSIDE TOWER:
257cd/m²

-FROM OUTSIDE TOWER:
379 cd/m²

APPENDIX B: VISIBLE BRIGHTNESSES FROM TOWER

B7 - LEVIS STADIUM



LUMINANCE RANGE:

1: DIGITAL DISPLAY SIGNAGE

-FROM INSIDE TOWER:
20cd/m²

-FROM OUTSIDE TOWER:
67 cd/m² MAX

APPENDIX C: ONSITE EXAMPLES OF SIGNAGE

C1 - DIGITAL DISPLAY SIGNAGE - BOOK OF LIFE



LUMINANCE RANGE:

1: DIGITAL DISPLAY

-COLOR: ORANGE
142 cd/m²

C1 - DIGITAL DISPLAY SIGNAGE - CHILD

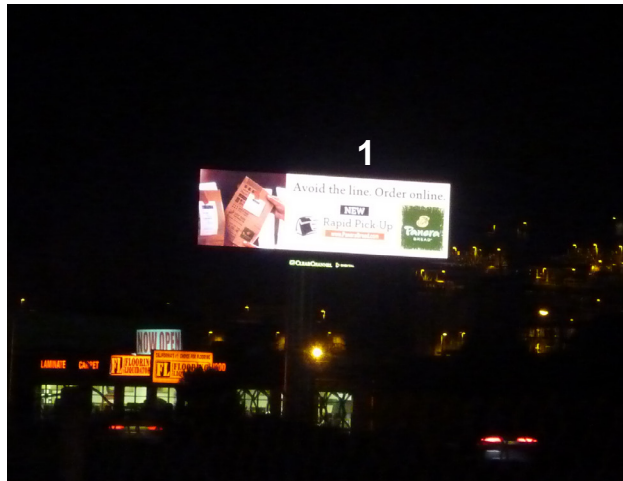


LUMINANCE RANGE:

1: DIGITAL DISPLAY

-COLOR: RED
73 cd/m²

C3 - DIGITAL DISPLAY SIGNAGE - PANERA



LUMINANCE RANGE:

1: DIGITAL DISPLAY

-COLOR: ORANGE
35 cd/m²

APPENDIX C: ONSITE EXAMPLES OF SIGNAGE

C1 - DIGITAL DISPLAY SIGNAGE - TEXT



LUMINANCE RANGE:

1: DIGITAL DISPLAY

-COLOR: BLUE
21 cd/m²

C1 - DIGITAL DISPLAY SIGNAGE - ER



LUMINANCE RANGE:

1: DIGITAL DISPLAY

-COLOR: WHITE
107 cd/m²

C1 - DIGITAL DISPLAY SIGNAGE - KQED



LUMINANCE RANGE:

1: DIGITAL DISPLAY

-COLOR: PINK
50 cd/m²

APPENDIX C: ONSITE EXAMPLES OF SIGNAGE

C1 - DIGITAL DISPLAY SIGNAGE - TEXT



LUMINANCE RANGE:

1: DIGITAL DISPLAY

-COLOR: BLUE/WHITE
85 cd/m²

C1 - DIGITAL DISPLAY SIGNAGE - ER



LUMINANCE RANGE:

1: DIGITAL DISPLAY

-COLOR: BLACK
23 cd/m²

C2 - BACKLIT STATIC GRAPHIC



LUMINANCE RANGE:

1: BACKLIT STATIC GRAPHIC

-COLOR: WHITE
443 cd/m²

APPENDIX C: ONSITE EXAMPLES OF SIGNAGE

C3 - BACKLIT BOX - LETTER SIGNAGE



LUMINANCE RANGE:

1: BACKLIT STATIC GRAPHIC

-COLOR: PINK
130 cd/m²

C4 - BACKLIT BOX - LETTER SIGNAGE



LUMINANCE RANGE:

1: BACKLIT STATIC GRAPHIC

-COLOR: WHITE
960 cd/m²

C5 - BACKLIT BOX - LETTER SIGNAGE



LUMINANCE RANGE:

1: BACKLIT STATIC GRAPHIC

-COLOR: WHITE
760 cd/m²