

**Glare Study**  
for the  
**Proposed Renovation of**  
**650 North Pacific Coast Highway (PCH)**  
El Segundo, California

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## Introduction

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This study is to determine whether the west-facing façade (part of proposed renovations) for the existing 7-story building at 650 North Pacific Coast Highway (Sepulveda)<sup>1</sup> would create a new source of substantial light and glare which would adversely affect day or nighttime views in the area.



**Figure 1 Existing Facade 650 NPCH**

The existing building has an estimated 15% window to wall ratio. The proposed new façade increases the window wall ratio to over 80%. Considering the number of cases in which reflected glare from new glass facades has created glare that caused damage to adjacent buildings and affected the use of adjacent property, the impact that this proposed façade might create raises legitimate concerns.



**Figure 2 Proposed New Façade 650 NPCH**

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<sup>1</sup> For the purposes of this report, Pacific Coast Highway (Sepulveda) will be referred to as “PCH” and the 7-story building being renovated will be referred to as “650 NPCH”.

## Glare

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The Illuminating Engineering Society is the only ANSI-certified standards-writing trade association in the general field of light and lighting. In their Lighting Handbook, IES describes glare this way.

*“Glare occurs in two ways: luminance is too high, or luminance ratios are too high. First, it is possible to have too much light. Too much light produces a simple photobiotic response in which the observer squints, blinks or looks away. Too much light is common in full sunlight. The only solution to the problem is to reduce the retinal illuminance by obscuring a bright part of the visual field – by wearing a cap with a brim – or by lowering the luminance of the of the whole visual field – by wearing sunglasses. Second, glare occurs when the range of luminance in a visual environment is too large. Glare of this sort can have two effects: a feeling of discomfort and a reduction in visual performance.”<sup>2</sup>*

The glare that might be associated with the new façade on 650 NPCH is of the first kind (too much light caused by full sunlight). This is because window glass acts like a mirror. A specular<sup>3</sup> reflection of sunlight from the new window glass facing due west will cause sun reflections after noon to be in the westward direction at a time when solar glare will normally be in the eastward direction. The significant increase in the amount of glass will cause more reflections and at more angles than the current windows cause.

In the past decade, solar reflections from new buildings have caused several well publicized sunlight reflection problems:

- The Vdara Hotel, Las Vegas
- The Nasher Museum Sculpture Garden, Dallas
- 20 Fenchurch Street (the “Walkie Scorchie”), London
- The Disney Concert Hall, Los Angeles

The first three were the direct result of sunlight reflected from window glass. The Disney Concert Hall was the result of a polished metal skin on the building.

## The Proposed Project

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The proposed project is a renovation and expansion of the existing office building and surrounding structures described on Page 2. Architects supplied complete drawings and

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<sup>2</sup> Chapter 4.10, “Glare”, **Illuminating Engineering Society IES Lighting Handbook**, 10<sup>th</sup> Edition, New York 2011.

<sup>3</sup> “Relating to or having the properties of a mirror”, Oxford English Dictionary via Google

elevations for our review. They were then asked to describe the project and the windows and cladding to be used. Their response was as follows:

*“The Project is comprised of 3 different buildings, two are existing (‘650 PCH-Building A’ and ‘700 PCH-Building B’), and one is new construction (‘Building C’). Building A is a 9-story office building that will be re-clad in a predominately all glass curtain wall on the east and west elevations, and will maintain a predominately solid, painted concrete north and south elevation. Although a manufacturer has not yet been chosen, all of the glass proposed for the east and west elevations will be low-E, highly transparent in nature. Visible reflectivity on the glass will be held to a minimum, as the general aesthetic of the building is to be “see-through”. Any metal cladding on the curtain wall system will be finished with Aluminum Composite Panels (ACP), with matte white or matte, clear anodized aluminum finish. The painted concrete on the north and south elevations will be painted with low sheen paint and clad limitedly in matte finish Aluminum Composite Panels (ACP) with matte white or matte, clear anodized aluminum finish.*

*Building B is an existing 2 story masonry building (only 1 story high along PCH). Very little façade work is planned for this building. It is proposed that the existing red brick will be stained with a full body, solid stain. Color will be dark grey, and the sheen will be ultra-flat.*

*Building C will be a new 7 story office building that will be built the east (and behind) the 9 story 650 PCH building. Generally speaking, Building C will not be visible from PCH or any of its residential neighbors to the west. Similar to the Building A, Building C will predominately be clad in glass curtainwall. It will be low-E and highly transparent in nature. Visible reflectivity on the glass will be held to a minimum, as the general aesthetic of the building is to be “see-through”. Any metal cladding on the curtain wall system will be finished with ACP, with matte white or matte, clear anodized aluminum finish.*

*We plan no lighting out of the ordinary for a typical office building of this scale. The project is three separate buildings. The building that will have the most exposure to general public and possible residential exposure will be Building A. Mostly all the artificial lighting on that building exterior will be from light emitting from the interior environment. The entry areas and exit doors will have minimal El Segundo City code required lighting for safety and security that will be directed downwards and shielded to minimize spill and glare to adjacent properties. The north and south sides of the building will have lighting for visibility from PCH. These lights will be shielded with a focused light distribution directed towards the building to minimize spill and glare. The roof terrace will have well shielded, low lumen downlighting and landscape tree lighting. Building B will have minimal, downward directed entry, exit and perimeter lighting for safety and to meet El Segundo City codes. Building C will have low level lighting for safety at exterior terraces. The courtyard that connects the 3 buildings of the campus will have lower-level pole lighting and low lumen landscape and feature lighting to provide a safe nighttime environment for people to move between buildings. This courtyard is surrounded on all sides by the buildings and a perimeter site wall so no light will spill to adjacent properties or be visible from offsite.*

*At a minimum, we will design per Cal Green requirements, which are some of the most forward thinking and environmentally considerate design parameters in the country. We will be utilizing a new Variable Refrigerant Flow (VRF) HVAC system which allow for both heating and cooling*

*within the space. This system is known to exceed Title 24 efficiency compliance and does not require any gas usage. All lighting will be on control systems with auto daylight dimming and light fixtures will be the state of the art, LED type which exceed CALGreen and Title 24 energy compliance. All plumbing fixtures will have low flow and auto sensors for water conservation, and again, will be equal to or outperform Title 24 compliance.”*

Electric lighting issues were immediately ruled out based on the Architect’s description. No significant amount of glare will be caused by buildings other than building “A” (650 NPCH). Attention was focused on solar reflections from the windows on its prominent west curtain wall.

## Direction of Reflected Light

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Because the curtain wall faces west, all reflections will be to the west of the building front and will be in the general north-south direction of the actual sunlight but in the opposite of the normal east-west direction. Using a solar calculator, it is possible to predict the exact direction of sunlight on any given date and time and it is reasonably easy to the direction of sunlight reflected by them. Of course, on cloudy days there will be no reflection of the sun, only that of the clouds.

The angle of the reflected sunlight will constantly change with the “movement” of the sun<sup>4</sup> and, when standing still and staring at the new 650 NPCH facade, the sun’s reflected image will appear to move across the facade. The solar angle at noon ranges from a low elevation of 32 degrees on the winter solstice to almost 80 degrees at the summer solstice, which means that the mid-day summer reflections will be down onto the sidewalk and street, and winter impacts will reach further and exhibit longer shadows. The setting sun in the west will be reflected too, at the same time as the actual sunset

To illustrate where the reflected light will be directed, the following generally illustrates the impacts at each point for the instant when the viewer is at the exact angle to see the reflection. The following times were selected to illustrate the range of impacts and their daily and seasonal variety:

- When viewing a point near the top of the building at about 12:30 pm each day, the reflection will be towards the north-northwest along PCH. In summer, the reflection will be onto the sidewalk about 30’ north of the viewpoint; in fall and spring, the reflection will be onto the outer northbound lane of PCH about 100’ beyond the building; and in the winter, the reflection will be onto the inner northbound lane of PCH about 240’ beyond the building. Throughout the morning, the reflections will move to the northwest, but will not directly affect buildings across PCH.

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<sup>4</sup> The apparent movement of the sun is the result of the earth’s daily rotation on its axis and its annual path around the sun.

- When viewing the center of the building near the top at 3:00 pm each day, the reflection will be across PCH towards the E. Palm intersection. In summer, the reflection will be directly into the eyes of a motorist or cyclist facing east towards the building; in spring and fall, that reflection will occur to the left of center and at a point about 1 story below the top; and in the winter, that reflection will strike the roof of the Carl's Junior across the street. As the afternoon wears on, the reflections will rotate south towards the Carl's Junior parking lot.
- At 25 minutes before sunset, in the summer the setting sun will be reflected in the general direction of the east facing windows of apartments at 600-620 Illinois Ct. In the spring and fall the reflection will be west along E. Palm Ave and towards the east facing windows on the upper stories of apartments at 1630 and 1637 E. Palm. In the winter, the reflections will be towards the upper floor apartments at 1637 E. Palm and 716 Indiana Ct.
- Due to trees and buildings, glare visible in and to the west of Washington Park will be minimal and even less impactful than the glare described above.

The reflection will only last about 5-10 minutes at each point of view as the "movement" of the sun will cause of the reflection to move across the 650 NPCH façade before shifting to the south until sunset.

## Intensity of Reflected Light

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Although all window glass will have specular reflections, the percentage of reflected light varies depending on coatings that are applied to the glass during the float process. These coatings are a thin metallic or metallic oxide layer deposited on the glass. The layer will alter the color of the glass, the amount of reflected light from the glass, and the amount of infrared energy that is either reflected away or passed into the building. In this way, windows are used to manage solar heat, an important element in building energy efficiency. Choosing the proper window glass and coatings is one of the most important decisions made by architects, as their choices affect both the appearance and the efficiency of the building. For office building curtain walls, two window panes are held together with an air gap for insulation and are called a commercial glazing unit.

There are two distinctively different types of commonly used commercial glazing units:

- **Reflective glass windows** that look like a mirror from the outside. They reduce both the amount of infrared light and the visible light entering the building. They can also impart coloration if a tint is used. Reflective glass windows are generally silver in appearance but can also be tinted blue, green, gold or bronze.
- **Low-emissivity ("low-e") windows** that are clear or slightly tinted in appearance. Low-e windows reflect infrared light but permits visible light to enter the building.

In both cases, the inside surface of the outer pane is coated with the metal oxide layer. Both panes are typically clear glass, although tinted glass can also be used. Generally, the low-e windows are more desirable because they allow significantly more visible light into the building and render a more realistic view. Reflective glass, while impressive in appearance, reduces interior light and view. From the architects' comments and desire to have a "clear" view through the building, the appropriate windows will be a low-e type with high visible light transmission (VLT) and low visible light reflection (VLR).

To reduce the glare of a reflected solar image, commercial glazing units with a VLR value of between 8 and 13% will reduce the glare in the reflection by 87-92%. The windows will appear as rendered by the architects (Figure 2) especially if low-iron clear glass is used for both panes, and the impact of the glare will be much less than direct sunlight.

One other consideration is the building's use of polished metals. The architects' description of the other building finishes does not suggest any large areas that will create mirror like reflections on a scale for which concern is warranted.

## Summary

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In summary, solar reflections from the facade's window glass will cause modest glare throughout the afternoon and into the evening along PCH and onto the retail properties, parking lots and nearby apartments to the west of 650 NPCH. However, the impact will be about 10% of the normal impact that occurs due to direct sunlight in the morning at the same locations, which is visually the equivalent of wearing dark sunglasses for attenuating the glare. As long as the window glass complies with the characteristics described above, the impact of the new glass curtain wall relative to glare will be much less than significant.



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