# Homewood Hilton Suites

Sunnyvale, CA

# Sun Shadow Study

RWDI # 1604045
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**SUBMITTED TO**

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## 1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Awbrey Cook Rogers McGill to conduct a shadow study for the proposed Homewood Hilton Suites in Sunnyvale, CA. The objective of this study was to quantify the shadow impact of the proposed building on the roofs of the nearby Walgreens and Panda Express buildings as required by the City of Sunnyvale.

## 2. BUILDING AND SITE INFORMATION

The proposed building will be four stories tall and located southwest of the intersection of E El Camino Real and Maria Lane in Sunnyvale, CA. The Panda Express and Walgreen buildings are located to the NW of the site, as shown in Image 1. Surroundings comprise of one to two story commercial and residential buildings that would not cast a shadow on the areas of concern.


**Image 1:** Aerial View of Site and Surroundings
*(Courtesy of GoogleEarth™)*

# 3. METHODOLOGY

## Computer Model

This study involved the use of a three-dimensional (3D) computer model of the proposed development with the Panda Express and Walgreens buildings in place. The model was created in accordance with the following information provided by Awbrey Cook Rogers McGill:

- Sketchup model and site plans received on August 12, 2016; and,
- Survey data received on July 25, 2016.

The roofs of the Panda Express and Walgreens buildings were modelled as 149.97 ft high based on the survey data. The 3D model was used to produce renderings of the shadows cast by the proposed development on the roofs of the adjacent buildings.

## Shadow Area Calculation

The study surfaces, i.e. the roofs of the Panda Express and Walgreens buildings, were broken up into numerous small sub-surfaces, each approximately 1 sq. ft in area so that the spatial distribution of daylight could be assessed. Next, the sun's position in the sky relative to the site was computed. Virtual "rays" were then drawn from this position to each of the sub-surfaces. The rays are then tested to see if they are obstructed by the Homewood Hilton Suites building, and thus are in shadow.

This process is repeated at 1 hour increments from 9am to 3pm for every day in a year. The percentage of the hours each subsurface is in shadow is computed. The area-weighted average percentage of hours shadowed is then calculated for each of the roofs in question, yielding the overall result.

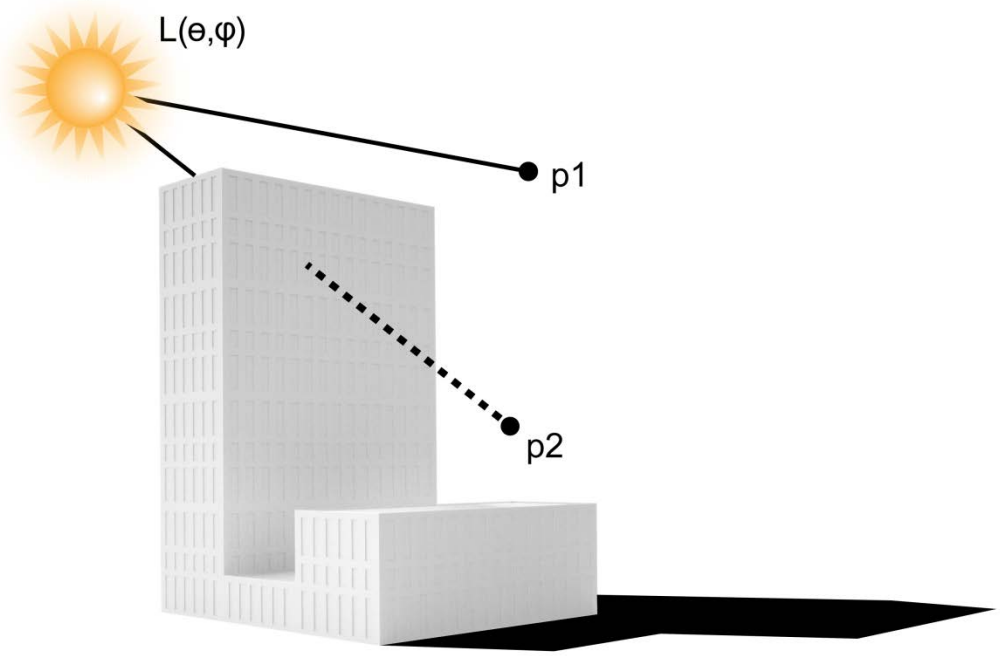


**Image 2:** Schematic of the ray tracing process.
For a given solar position (L), p2 would be considered shadowed.

# 4. RESULTS

On an annual average basis, we found no shadowing from the Hilton on the Walgreen roof and an average shadow percentage of 4.9% on the Panda Express roof (Image 3). This value is well below the threshold of 10% set by the City of Sunnyvale. In fact, in approximately 70% of the hours of interest, the Hilton casts no shadow at all on the Panda Express.

Detailed quantitative results of the shadow analysis are provided for the Panda Express building and the Walgreens building on the following page. (Tables 1 and 2 respectively.) The tables present the average percentage of roof area shaded for each hour from 9:00 am to 3:00 pm for each month.

As shown in Table 1, the hours when greater than 10% of the roof is shadowed are limited to the morning hours during the winter months when any building naturally creates larger shadows. For the months of May through September there is essentially no shadowing predicted on the Panda Express roof.

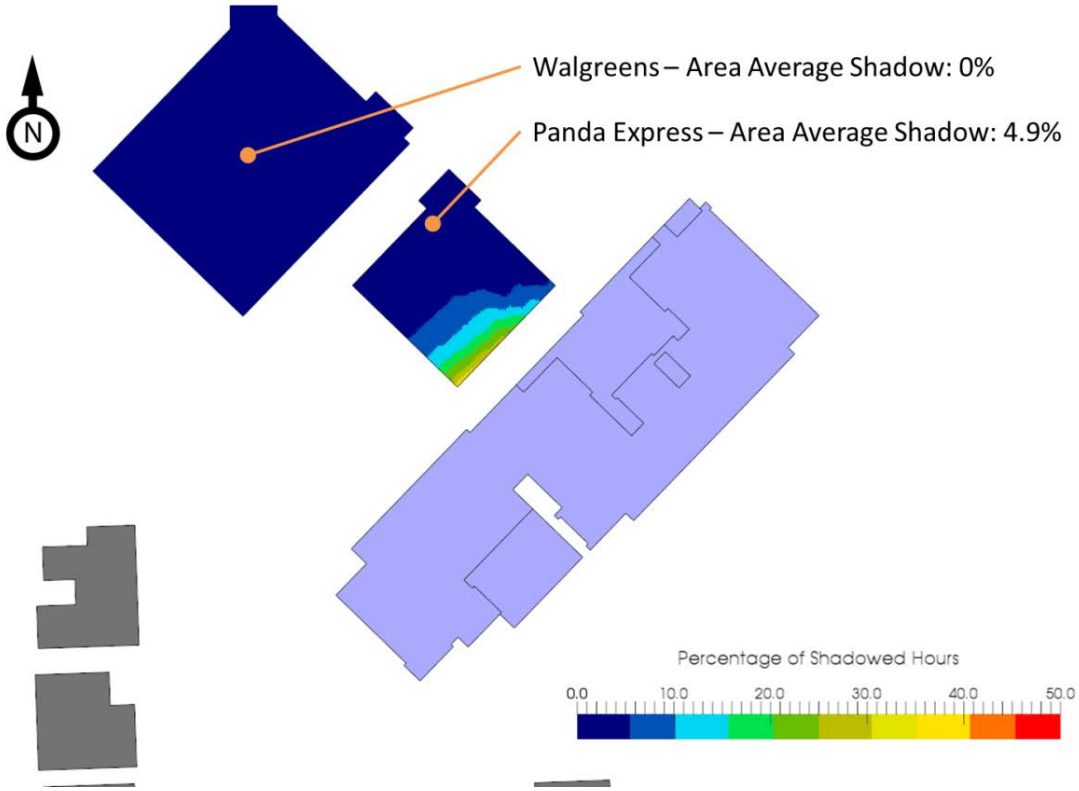


**Image 3:** Percentage Of Shadowed Hours

# 4. RESULTS

**Table 1:** Percentage of Roof Area Shaded – Panda Express

| | TIME | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MONTH | 9:00 | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | **Average** |
| Jan | 58.32% | 30.35% | 18.01% | 8.17% | 1.36% | 0.00% | 0.00% | **16.60%** |
| Feb | 29.29% | 15.93% | 7.27% | 1.47% | 0.00% | 0.00% | 0.00% | **7.71%** |
| Mar | 10.29% | 4.25% | 0.61% | 0.00% | 0.00% | 0.00% | 0.00% | **2.16%** |
| Apr | 1.65% | 0.12% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.25%** |
| May | 0.02% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Jun | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Jul | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Aug | 0.60% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.09%** |
| Sep | 5.21% | 1.05% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.90%** |
| Oct | 15.54% | 7.61% | 1.65% | 0.02% | 0.00% | 0.00% | 0.00% | **3.55%** |
| Nov | 34.87% | 20.55% | 10.58% | 2.94% | 0.04% | 0.00% | 0.00% | **9.85%** |
| Dec | 61.13% | 33.53% | 20.36% | 9.75% | 2.04% | 0.00% | 0.00% | **18.12%** |
| **Average** | **18.07%** | **9.44%** | **4.88%** | **1.88%** | **0.29%** | **0.00%** | **0.00%** | **4.94%** |

**Table 2:** Percentage of Roof Area Shaded – Walgreens

| | TIME | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MONTH | 9:00 | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | **Average** |
| Jan | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Feb | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Mar | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Apr | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| May | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Jun | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Jul | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Aug | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Sep | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Oct | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Nov | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| Dec | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | **0.00%** |
| **Average** | **0.00%** | **0.00%** | **0.00%** | **0.00%** | **0.00%** | **0.00%** | **0.00%** | **0.00%** |

# 5. APPLICABILITY OF RESULTS

The results presented in this report pertain to the model of the proposed project generated using the architectural design information provided by Awbrey Cook Rogers McGill, mentioned in Section 3. Should there be any design changes that deviate from current model, the results presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on sun/shadow conditions.