176 Johnston St & Napier St, Fitzroy

Daylight Modelling & Assessment Report

May 2020

S3939 Daylight.V2
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<th>Description</th>
<th>Author</th>
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1. Introduction

Sustainable Development Consultants (SDC), as part of a town planning application to the City of Yarra are running daylight simulations to compare the effect of the proposed development on the amount of daylight received by the bedrooms of Level 1 & 2 of the development at 178-182 Johnston Street through the light courts. This assessment is based on daylight modelling done on the Level 1 & 2 Bedrooms comparing the Existing Site Conditions (two 1 storey buildings with segments of pitched and flat roof on the subject site) and the Proposed Building form with all external finishes modelled.

Below are 3D images of the rendered view of the daylight models for the existing site conditions and proposed development. Note that the colour is for display purposes only.
Figure 2: An overall view of the daylight model including the proposed development, showing the sun-path at 12pm on 10th November as an example.
Figure 3: A view of the light courts that allow light into the level 1 & 2 bedrooms.
2. Daylight Modelling Methodology

The program DesignBuilder is a comprehensive analysis software package that uses the accurate physics-based Radiance simulation engine which utilises material types and finishes, glazing properties, reflectance off internal and external surfaces as well as local weather, latitude and longitude coordinates for the proposed site.

The analysis grid points are determined at just above the floor surface level. Results are presented using Daylight Factor (DF) which is the percentage (%) of the available daylight under a design sky. The simulation was undertaken using the CIE Overcast Day for Melbourne and the illuminance is set to 10,000 lux. This sky model represents the luminance distribution observed for overcast sky. The sky brightness increases gradually with altitude from the horizon to the zenith, but it does not vary with azimuth.

All building fabric which may overshadow the internal areas of the proposed development have been built in the model to provide an accurate simulation of the available light under the current proposed conditions.

Only the proposed development building was included in the model given the location of the bedrooms and their disconnect from other surrounding buildings.

Below is a list of applicable primary spaces:

- Level 1 Bedroom 1
- Level 1 Bedroom 2
- Level 2 Bedroom 1
- Level 2 Bedroom 2

3. Design and Performance

We have modelled the external windows as Clear double-glazed glass in aluminium frame with a (VLT) of 70%.

The bedrooms floors were modelled with a reflectivity of 0.1 (10%) based on the AS1668 typical reflectance values to be conservative.

Internal walls were modelled as being white colour plasterboard with a reflectivity of 0.7 (70%). External walls were modelled as having a surface reflectance of 0.4 (40%).

Ceilings were modelled as white colour plasterboard ceiling with a reflectivity of 0.7 (70%).

Window heights (vision glass) to the office are modelled as per floor plans and elevations.

All external surfaces are modelled in detail with elements that could overshadow or reflect light into the bedrooms being deemed important for the assessment and thus included in the model.
4. Results

The images in this section are lux/daylight factor map exported from the modelling program DesignBuilder which were produced by the Radiance simulation engine. Please note that they are graphical representation of the results only, for accurate results please refer to the result data table below.

<table>
<thead>
<tr>
<th></th>
<th>Average Daylight Factor with Existing Onsite Conditions (%)</th>
<th>Floor Area % above 0.5 DF threshold</th>
<th>Average Daylight Factor with Proposed Development Conditions (%)</th>
<th>Floor Area % above 0.5 DF threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Bedroom 1</td>
<td>2.1</td>
<td>100%</td>
<td>0.25</td>
<td>4.5%</td>
</tr>
<tr>
<td>Level 1 Bedroom 2</td>
<td>1.4</td>
<td>100%</td>
<td>0.19</td>
<td>5.6%</td>
</tr>
<tr>
<td>Level 2 Bedroom 1</td>
<td>1.5</td>
<td>100%</td>
<td>0.63</td>
<td>35.4%</td>
</tr>
<tr>
<td>Level 2 Bedroom 2</td>
<td>2.5</td>
<td>100%</td>
<td>0.59</td>
<td>36.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.869</strong></td>
<td><strong>100%</strong></td>
<td><strong>0.41</strong></td>
<td><strong>19.6%</strong></td>
</tr>
</tbody>
</table>

Lux/daylight factor map legend:
Figure 4: Existing Conditions daylight modelling results for Level 1

Figure 5: Proposed Development daylight modelling results for Level 1
Figure 6: Existing Conditions (on the left) and Proposed Development (on the right) daylight modelling results for Level 1 - Bedroom 1

Figure 7: Existing Conditions (on the left) and Proposed Development (on the right) daylight modelling results for Level 1 - Bedroom 2
Figure 8: Existing Conditions daylight modelling results for Level 2

Figure 9: Proposed Development daylight modelling results for Level 2
Figure 10: Existing Conditions (on the left) and Proposed Development (on the right) daylight modelling results for Level 2- Bedroom 1

Figure 11: Existing Conditions (on the left) and Proposed Development (on the right) daylight modelling results for Level 2- Bedroom 2
5. Conclusion

Figures 2 - 11 and the summary table demonstrate the daylight modelling results of the Level 1 & 2 bedrooms in 178-182 Johnston Street that are dependent on the light courts for daylighting. This modelling clearly demonstrates that a significant impact on the daylight received by those bedrooms will occur due to the proposed development on the subject site. Given the size and location of the light courts this is not a surprising outcome and demonstrates that the 178-182 Johnston Street project was approved in a way which did not anticipate future equitable development opportunities for the subject site.

SDC recommend that in order to improve the future daylight outcome to these bedrooms a much larger setback and/or much larger light courts will need to be provided within the subject site. It is our professional opinion that if the project limits the impact to still allow the bedrooms in the 178-182 Johnston Street project reliant on the boundary light courts to achieve best practice daylight for a bedroom (0.5% daylight factor across 90% of the room) then that should be sufficient for council approval (rather than trying to replicate an outcome similar to the existing conditions).

A starting point would be to replicate the same size light court provided on the 178-182 Johnston Street site within the subject site. Then following that if the daylight in those bedrooms is still not best practice a decision could be made as to whether or not the application should proceed as is or if further modifications are required. Equal light courts, even if they don’t provide the best practice outcome sought, may still be considered equitable by council and thus acceptable.
6. Optimisation

Light well walls with high reflective external surface have been modelled as a potential option to improve the daylight results of level 1 & 2 bedrooms in 178-182 Johnston Street.

Light well walls have been modelled to have a reflectivity of 0.8 (80%). This can be achieved by using light colour wall cladding with smooth surface such as Alucobond with gloss white coating or white glazed wall tiles.

<table>
<thead>
<tr>
<th></th>
<th>Average Daylight Factor with Existing Onsite Conditions (%)</th>
<th>Floor Area % above 0.5 DF threshold</th>
<th>Average Daylight Factor with Proposed Development Conditions (%)</th>
<th>Floor Area % above 0.5 DF threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Bedroom 1</td>
<td>2.1</td>
<td>100%</td>
<td>0.30</td>
<td>10.0%</td>
</tr>
<tr>
<td>Level 1 Bedroom 2</td>
<td>1.4</td>
<td>100%</td>
<td>0.21</td>
<td>7.1%</td>
</tr>
<tr>
<td>Level 2 Bedroom 1</td>
<td>1.5</td>
<td>100%</td>
<td>0.76</td>
<td>61.6%</td>
</tr>
<tr>
<td>Level 2 Bedroom 2</td>
<td>2.5</td>
<td>100%</td>
<td>0.62</td>
<td>40.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.869</strong></td>
<td><strong>100%</strong></td>
<td><strong>0.47</strong></td>
<td><strong>28.2%</strong></td>
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</tbody>
</table>
Figure 14: Existing Conditions (on the left) and Proposed Development (on the right) daylight modelling results for Level 1 - Bedroom 1

Figure 15: Existing Conditions (on the left) and Proposed Development (on the right) daylight modelling results for Level 1 - Bedroom 2
Figure 16: Existing Conditions daylight modelling results for Level 2

Figure 17: Proposed Development daylight modelling results for Level 2
Figure 18: Existing Conditions (on the left) and Proposed Development (on the right) daylight modelling results for Level 2 - Bedroom 1

Figure 19: Existing Conditions (on the left) and Proposed Development (on the right) daylight modelling results for Level 2 - Bedroom 2