HEGGIES

REPORT 10-5947-R3

Revision 0

Dwyers Site Development
31 Crown Street, Wollongong
Reflectivity Assessment

PREPARED FOR

Belmorgan Property Development Pty Ltd
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Dwyers Site Development

31 Crown Street, Wollongong

Reflectivity Assessment

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EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been engaged by Belmorgan Property Development Pty Ltd to conduct a solar reflectivity assessment of Stage 1 of the proposed re-development at 31 Crown Street, Wollongong, and the potential for impact on the surrounding environs.

Heggies' reflectivity analysis shows that there will be no glazing elements within the development facades which are capable of causing adverse glare events at surrounding locations for motorists (disability glare) under any condition, including off the development's curved glazed façade at the corner of Crown and Corrimal Streets.

This is due to the following factors:

- The development is only of a very modest height.
- The development's glazing will have a reflectivity coefficient of *less than 20%*.
- The facade design of the development involves a mix of glazing forms which limit the potential to generate significant glare, eg through recessing and façade indentations, blockage by structural column elements and shading elements, eg the Level 1 awning running along the location relative to facade indentations, etc.
- Some potential reflection conditions are eliminated due to the angle difference between the incoming reflections and the line-of-sight of motorists, eg motorists driving north along Corrimal Street relative to reflections off the development's curved northwest corner façade.

The analysis has also shown that the development's facades will not create pedestrian discomfort glare under any reflection conditions. A potential glare issue was identified in the analysis for reflections off mid-heights of the development's curved glazed façade at the corner of Crown and Corrimal Streets impacting on pedestrians with a line-of-sight to the east, ie waiting to cross Corrimal Street at the Crown Street and Corrimal Street lights.

However, the proposed development incorporates a Level 2 awning (refer **Figure 2**) running along the perimeter of the Corrimal-Crown Street curved façade section of similar dimension to the development's Level 1 awning. This awning will eliminate any potential pedestrian discomfort glare condition.

In summary, through a combination of choice of glazing, facade design,
facade orientation and surrounding thoroughfare orientation,
no facades of the development will produce reflections causing either disability glare
for passing motorists or unacceptable discomfort glare for passing pedestrians.

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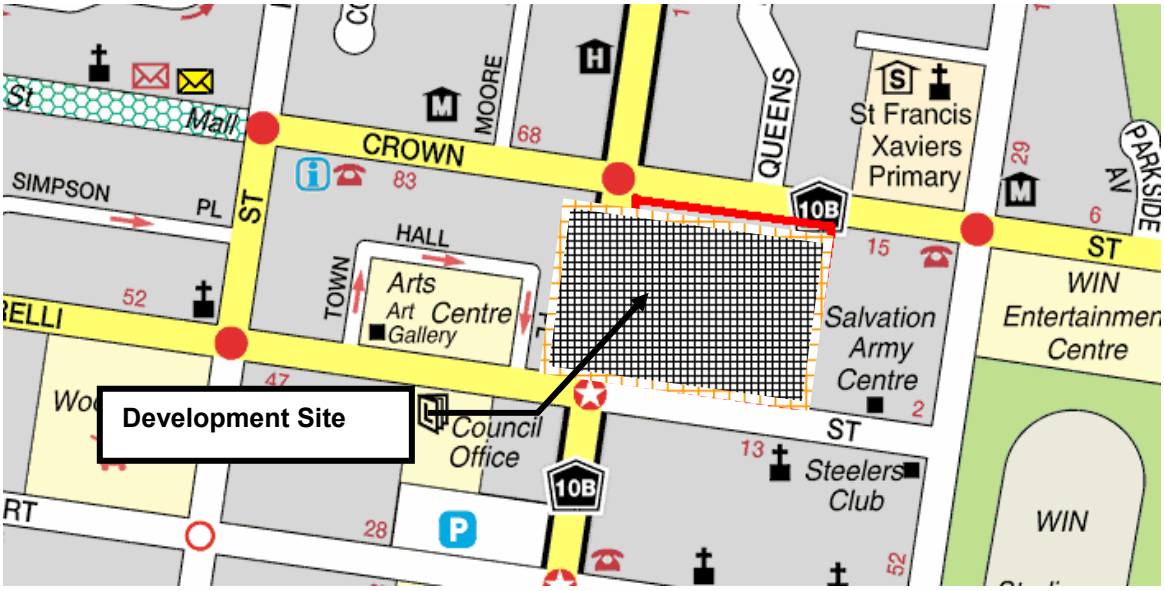
1 INTRODUCTION & SITE DESCRIPTION

Heggies Pty Ltd (Heggies) has been engaged by Belmorgan Property Development Pty Ltd to conduct a solar reflectivity assessment of Stage 1 of the proposed development at 31 Crown Street, Wollongong, and the potential for impact on the surrounding environs.

The development site is shown in **Figure 1** and is bounded by Crown Street to the north, Corrimal Street to the west and Burelli Street to the south.

Figure 1 31 Crown Street Development Site, Wollongong



1.1 Points of Interest with Respect to Reflectivity

Primary facade materials include the following:

- The glazing chosen for the proposed development will have a reflectivity coefficient of *less than 20%*.
- The other main facade materials will be rendered / painted concrete with minimal reflectivity.

The facade design overlooking surrounding carriageways involves a mix of glazing forms which limit the potential to generate significant glare, eg through recessing within building indentations, protection by external structural columns, etc.

2 REFLECTIVITY IMPACT CONSIDERATIONS

2.1 Glare Characteristics

With respect to the reflectivity impact of the proposed development, the following issues are relevant:

- At large incident angles (typically greater than 70^{o}), the reflectivity of all glazing types *increases dramatically*. Thus, regardless of the glazing type, the potential for glare increases significantly when incoming solar rays can impact on a building close to parallel to the plane of the glazing.
- On a practical level, incoming solar rays with an altitude angle *greater than* 20^{o} are intersected and obstructed by a typical windscreen roof-line. In this Report, it is assumed that the sun altitude angle must be *less than* 25^{o} to have the potential to produce a traffic disability glare event.
- Pedestrian discomfort glare can occur when the sun altitude is greater than 25^{o}. However, in most such instances, a pedestrian has the ability to adjust his/her line of sight to a more horizontal view away from the glare source.
- It is assumed that glare events can only occur when the solar altitude is greater than about 3^{o}, enabling the entire solar disc to be visible.
- The facade on the corner of Crown Street and Corrimal Street is curved, and for the purpose of simulation it has been split into five flat panels to approximate the curved section.

2.2 Glare Acceptability Criteria

The criteria used within this Report to assess the acceptability or otherwise of glare events are the limiting values of the so-called *"Threshold Increment Value"*, or *TI Value,* of the reflection condition, as shown in Table 1.

Table 1 Threshold Increment (TI) Criteria

Glare Category	Classification	TI Acceptable Limit
Disability Glare (for motorists)	Major Roads	10
	Minor Roads	20
Discomfort Glare (for pedestrians)	Pedestrian Crossings	2
	Other Footpath Locations	3

2.3 TI Value Assessment Sites

All surrounding traffic areas were examined for disability and discomfort glare including Crown Street and Corrimal Street. The relatively modest height of the development's buildings precludes the possibility of reflected glare on streets further a field.

Particular attention was paid to the glazing elements located on the development's curved façade at the corner of Crown and Corrimal Streets.

3 REFLECTIVITY IMPACT ASSESSMENT

Heggies carries out reflectivity TI calculations using a three-stage screening process:

- In the first stage, road traffic conditions are examined to exclude reflection conditions which are *"not possible"*.
  - For example, traffic along many CBD streets can be one-way. Thus, it may not be possible for drivers to be impacted by solar reflections in certain instances if the reflected ray off a building of interest is in the same direction as the direction of travel of the motorist, ie the incoming reflection is from *"behind"* the motorist.
- In the second stage, the potential for reflections is established by carrying out a *"baseline"* screening calculation whereby the facade of interest is assumed to consist totally of reflection-producing glazing. The reflectivity coefficient of the glazing to be used is taken into account however in these baseline screening calculations.
- If a reflection potential is indicated, accurate TI values are then calculated in the third stage utilising the actual details of the facade geometry, taking into account recessing of glazing, blockage produced by horizontal and vertical shading elements, sections of masonry facade, etc.

3.1 Traffic Disability Glare Impact

3.1.1 Reflections Impacting on Crown Street

Reflection conditions associated with the development's north facade (overlooking Crown Street) that have been examined are:

- Early morning solar rays striking the northern facade throughout the year from the east to northeast with reflections towards the west along Crown Street.
- Afternoon solar rays striking the northern facade from the northwest with reflections back toward the east.

It is firstly noted that the development's glazing will have a reflectivity coefficient of *less than 20%*. Location examined in the analysis ranged from approximately 50 m west of the Crown and Corrimal Street intersection (for motorists travelling east) to past the development's eastern most point (for motorists travelling west).

In relation to morning reflections off the northern facade, a number of factors contribute towards TI values being minimal or non-existent for all of the examined conditions, in particular:

- The facade areas of interest are of modest height, thereby limiting the potential incoming solar angles able to create reflections which can impact at far field locations.
- Furthermore, the northern façade has a slight northwest-southeast inclination which lessens the impact of mid-winter low altitude morning rays
- The design of the northern facade incorporates an articulated facade with sections of recessed glazing (eg façade sections in front of Cinemas 3-8) which limits the potential for this facade to create reflections. Reflections off the protruding masonry sections (such as balcony privacy screens) will produce diffuse type reflections without potential to generate specular glare reflections.

In relation to afternoon reflections off the northern facade, the baseline TI screening calculations (ie assuming uninterrupted glazing flush with building faced perimeter) indicated a potential for glare conditions for motorists travelling west along Crown Street under the following conditions:

- Motorists travelling west in the lane closest to the building
- Reflections off the building for solar rays striking at a height less than 5 m above ground level

Further detailed calculations were therefore carried out taking into the actual façade details of the northern façade, ie indentations, recesses, horizontal and vertical structural elements and canopies, etc. In this instance, the potential glare conditions were shown to be non-existent due to the following factors:

- Recessing of the glazing for façade sections up to a height of 5 m above ground level
- Blockage from structural columns and, in particular, the continuous Level 1 Awning which runs along the Crown Street and Corrimal Street perimeters of the building.

As a consequence, our calculations at all relevant locations yield negligible or non-existent TI values.

3.1.2 Reflections Impacting on Corrimal Street

Reflection conditions associated with the development's west facade that have been examined are:

- Mid-winter (low altitude) solar rays striking the curved corner facade of the development from the north-northeast with reflections towards the south along Corrimal Street.
- Midday winter (low altitude) solar rays striking the western facade of the development from the north with reflections towards the south along Corrimal Street.

Once again, it is noted that the development's glazing will have a reflectivity coefficient of *less than 20%*. Location examined in the analysis ranged from approximately 10 m south of the Crown and Corrimal Street intersection to the development's southern most point (for motorists travelling north).

The baseline TI screening calculations show that reflected solar rays along Corrimal Street from the development's western façade and curved facade near the corner of Corrimal and Crown Streets are expected to produce minimal or non-existent TI values due to the following factors:

- The modest height of the development's facades of interest
- The offset distance of motorists heading north along Corrimal Street from the facades of interest.
- The angle difference between the line-of-sight of motorists heading north along Corrimal Street and incoming reflected rays.

3.2 Pedestrian Discomfort Glare

The above calculations were repeated to examine glare conditions affecting pedestrian locations, especially at nearby traffic intersections.

In the "baseline" calculations, factors such as facade design, recessing of glazing, limited building height, blockage from structural columns, the Level 1 awning running along the perimeter of the development, etc, resulted in acceptable TI values for all reflection conditions with the exception of the following:

- Solar rays incoming from the northeast, reflected off the curved façade at the corner of Crown and Corrimal Streets at around the Level 2 RL height and then impacting on pedestrians standing on the southwest corner of the intersection facing eastwards (ie waiting to cross to the other side of Corrimal Street).

The calculations were then repeated taking into account a proposed Level 2 awning running around the curved façade section of interest with approximately the same dimensions (ie width-wise) as the Level 1 awning, but extending only around the curved façade perimeter. This awning is shown in **Figure 2**.

Detailed TI calculations indicated that the awning shown below will eliminate the potential pedestrian discomfort glare condition of concern.

Figure 2 Location of Proposed Level 2 Curved Façade Awning

3.3 Glare Intensity

The calculations undertaken to investigate TI values around the site show that the local glare intensity, expressed as Cd/m^2, in surrounding public areas, is minimal, and hence well below the Sydney City Council limiting criterion of 500 Cd/m^2.

4 REFLECTIVITY SUMMARY

The Reflectivity Analysis of the development shows that there will be no glazing elements within the development facades which are capable of causing adverse glare events at surrounding locations for motorists (disability glare) under any condition, including off the development's curved glazed façade at the corner of Crown and Corrimal Streets

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