

# Visual Comfort

## Aim of Credit

To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.

## Credit Criteria

There is one conditional item that must be addressed in order to claim any points in this credit. Two points are available in this credit. Each point is independent from the other.

0	Glare Reduction	It is a condition of this credit that glare in the nominated area from sunlight through all viewing façades is reduced through a combination of blinds, screens, fixed devices, or other means.
1	Daylight	1 point is awarded where a 50% of the nominated area receives high levels of daylight during, 80% of the nominated hours.
2	Views	1 point is awarded where 60 % of the nominated area has a clear line of sight to a high quality internal or external view.

## Compliance Requirements

### Nominated Area

For the purposes of this credit, the nominated area is all primary spaces, apart from those spaces excluded for function reasons.

Where the functional requirements of the space require that lighting requirements differ from the requirements of this credit, these areas may be excluded. The reasons for exclusion must be justified by the project team. For example, an operating theatre or cinema should be excluded from the nominated area for this credit.

### Primary Space

Primary spaces are defined as all areas where a person is expected to remain for an extended period of time. Examples of primary spaces include:

- Living spaces
- Kitchens
- Offices, either open plan or private
- Classrooms, laboratories, computer labs
- Ward rooms, nurse's stations, clinic rooms
- Kitchen and preparation areas where food is being sold;
- Retail / sales floor, exhibition halls, galleries, multi-purpose rooms (as a general setting)
- Occupied industrial spaces, warehouse areas, shop floors, work stations.

Where it is unclear, a primary space would typically be defined as a space where a person would remain either for 1 hour continuously, or 2 hours cumulatively in one day.

Bedrooms, sleeping areas and bathrooms would not usually be considered primary spaces.

### **Nominated Hours**

Nominated hours are to be defined by the project team. The project team shall provide a summary of space types, uses and nominated hours.

### Overcast sky

Overcast Sky is defined as a sky with a completely closed cloud cover (100 %). This is the sky condition applied in daylight factor calculations (ISO 15469:2004 or CIE S 011:2003).

### Uniform sky

Uniform Sky represents a sky with a constant value of luminance. Thus, no matter where in the sky you look, the model has the same value (ISO 15469:2004 or CIE S 011:2003).

### Viewing Façades

For Green Star credits, viewing façades are defined as any part of the building's façade through which occupants can view the external environment. In walls, glazing and perforated façades are considered viewing façades. In the roof, transparent skylights are considered viewing façades. Translucent sheeting in the roof and walls is excluded from the credit.

## **0 – Glare Reduction**

A combination of the methods outlined below, can be used to achieve this credit.

Option A	<p><b>Fixed Shading Devices</b></p> <p>Fixed devices must be shown to shade the nominated plane, 1.5 meters in from the centre of the plane of the viewing façade. The nominated plane must be shown to be shaded from direct sun for 80% of the nominated hours for each day of the winter and spring equinoxes and the summer and winter solstices.</p>
Option B	<p><b>Blinds/Screens</b></p> <p>Either manual or automated blinds are acceptable. Internal, in-glazing, or external blinds can be used as well.</p> <p>Where automated blinds are used, these can be controlled either by a management system or by a manually-activated switch. All automated blinds and screens must be equipped with a manual override function accessible by occupants in each of the adjacent spaces served.</p> <p>All blinds must meet the following criteria:</p>

	<ul style="list-style-type: none"> <li>• The blinds must eliminate 95% of all direct sunlight penetration;</li> <li>• Blinds must be controlled by all affected occupants within each individual space; and</li> <li>• Blinds must have a visual light transmittance (VLT) of <math>\leq 10\%</math>.</li> </ul>
Option C	<p><b>Daylight Glare Model</b></p> <p>A combination of tinted glazing and fixed shading devices can be used to meet the Credit Criteria, provided that it will result in a reduction of glare to the user equivalent to Glare Reduction Option A: Fixed Shading Devices. The following must be provided:</p> <ul style="list-style-type: none"> <li>• A description of the methodology used to create the daylight glare model and the software used;</li> <li>• A description of how the selected points for modelling represent the areas that would be effected by glare;</li> <li>• All terms clearly defined;</li> <li>• All names, types, glazing properties, and location of glazing; and</li> <li>• Justification of how the results in the model are equivalent to that of the Credit Criteria.</li> </ul>

Should the requirement for both elimination of 95% daylight penetration **and** a VLT be included for blinds?

Should Daylight modelling be based on an Overcast Sky or a Uniform Sky?

## 1 – Daylight

At least 50% of the project users must have access to daylight to perform their day to day activities. See 'Guidance' for the definition of 'users'.

There are three methods for achieving this criterion, one is a prescriptive method, and the other two are performance methods. A combination of methods is acceptable for demonstrating compliance.

Option A	<p><b>Deemed to Satisfy method</b></p> <p>It is acceptable to calculate the daylight access using manual calculations for simple designs. To use manual calculations, there must be negligible overshadowing of glazed areas and separate calculations must be provided for each space.</p> <p>Refer to the GBCA Green Star Daylight Hand Calculation Guide for further guidance.</p>
Option B	<p><b>Compliance using Daylight Factor</b></p> <p>50% of the nominated area has a Daylight Factor (DF) of at least 2.0%; at finished floor level (FFL) under either a CIE overcast sky, or a CIE uniform sky.</p>
Option C	<p><b>Compliance using daylight autonomy</b></p> <p>50% of the nominated area has a Daylight Illuminance (DI) of at least 160 lux based on an annual dynamic simulation model, for 80% of the standard occupied hours.</p> <p>The daylight autonomy (DA) model can be done assuming that all shading devices are static, including all blinds. Blinds can be assumed to be open. The climate data nominated hours used must be the same as that used in the 'Greenhouse Gas Emissions' credit. Time intervals must be set at intervals of no more than one hour.</p> <p>There are a number of dynamic simulation software programs that can be used to show compliance with the credit criteria. Daysim, ESP-r, Lightswitch Wizard, and SPOT (&gt;ver 4.0) can be used. Where other programs are used, the project team must demonstrate that it is based on the Radiance simulation engine, and that it uses the statistical sky, the daylight coefficients &amp; Perez, or the annual CIE sky simulation algorithms.</p>

Is a daylight factor of 2.0% for 50% of the nominated area measured at the finished floor level an appropriate benchmark? Are the benchmarks for 'innovation opportunity' appropriate?

### Modelling guidance for Options B and C

Permanent partitions must be included within the modelling of this credit.

As a minimum, either option B or C must be calculated for at least one point for each square metre of floor area. A maximum 1sqm grid must be overlaid over the floor plan to determine these points and at all perimeters; each 1sqm must begin at the façade glass line.

### Reflectance Values

Project teams should define reflectance values to represent the project's design. If values are unknown, refer to a relevant standard for guidance.

### Overshadowing

Projects must include shading from any shutters or overhangs. A nearby building or feature (such as a cliff face) must be accounted for in overshadowing where the building height is at least a third of the height of the proposed building design; and where the angle between the nearest point at the top of that building and the nearest point base of the proposed building is greater than the 21 June (winter) midday altitude of the sun.

### Demonstrating Compliance

Compliance for this credit cannot be demonstrated by measurement of actual daylight levels in the building.

Compliance with this credit can be demonstrated through modelling of one or more representative floors. The modelled floor(s) must be representative of the typical daylight access found throughout the entire project, and account for overshadowing by adjacent buildings. Where the model has been simplified, the reason for the simplifications must be justified.

The engineer responsible for modelling must then justify how the floor is representative of the design, and certify that all other floors comply with this criterion.

## **Innovation Opportunity**

### Exceeding Green Star Benchmarks

Up to 2 points are available where a project can demonstrate that good levels of daylight are available to a higher percentage of the nominated area than is required for credit compliance.

- 60% - 2 points
- 90% - 3 points

## **3 – Views**

### **High quality internal or external views**

To consider this criterion met, the 60% of the nominated area must have good access to views. There are two methods for achieving this criterion. A combination of methods is acceptable for demonstrating compliance.

Option A	<p><b>Internal Views</b></p> <p>A high quality internal view is defined as a view towards an area landscaped or containing a water feature, or an atrium or where frequent movement of people can be expected. A landscaped area must contain high plant density and may be vertical.</p>
Option B	<p><b>External Views</b></p> <p>The view must extend to the outside towards natural elements such as large bodies of vegetation, a body of water, frequent movement of (people, vehicles, or animals) or sky.</p>

### Calculating the line of sight towards a view

The line of sight is to be measured by extending a perpendicular line from the window or opening. A line at 45° can be used at the corners of windows or openings. The thickness of the external walls must be taken into account in the calculations, Internal or external columns can be ignored. All floor areas 8m from a window can be considered compliant with this criterion.

## Guidance

### Standards noted in this credit

ISO 15469:2004 (E) / CIE S 011/E: 2003 Spatial distribution of daylight

Other standards can be submitted for approval through a Credit Interpretation Request. For a standard to be recognised, this standard must:

Have been developed by an industry organisation;

Demonstrated uptake by the general construction industry; and

Be specific to daylight, or views, and provide recommendations for measuring, testing, and setting both maximum levels and recommended levels for all aspects of this credit.

### References and Further Information

Chartered Institution of Building Services Engineers, U.K. (CIBSE) (1999), Publications – Daylighting and Window Design, [www.cibse.org](http://www.cibse.org)

Farley, KMJ. Veitch, JA.(2001), A Room with a View: A Review of the Effects of Windows on Work and Well-Being, National Research Council Canada, Ottawa.

Heschong Mahone Group (HMG) (2003), Windows and Offices: a Study of Worker Performance and the Indoor Environment (Technical Report), California Energy Commission.

International Energy Agency (IEA) (2000), Daylighting in Buildings: A Source Book on Daylighting Systems and Components, [www.iea.org](http://www.iea.org)

Massachusetts Institute of Technology (MIT) (2006), 'Daylight Savings: Building with Natural Light', ScienceDaily, 15 November 2006, [www.sciencedaily.com/releases/2006/11/061114194440.htm](http://www.sciencedaily.com/releases/2006/11/061114194440.htm)

Osterhaus, W. K. E. (2005), 'Discomfort glare assessment and prevention for daylight application in office environments', Solar Energy, Vol.79, Iss.2, pp.140-158.

Standards Australia (2006), AS/NZS 1680.1-2006: Interior and workplace lighting – General principles and recommendations, [www.standards.org.au](http://www.standards.org.au)

## Documentation requirements

### ‘Design Review’ Submission (Optional)

Project teams are to submit information/documentation marked with an asterisk\* for ‘design review’

### As Built Submission

All project teams are to provide the following documentation

#### Submission Template\*

- Definition of nominated areas
- Definition of nominated hours
- Description of how the project meets the requirement for glare reduction
- Description of how the project meets the requirements for daylight
- Description of how the project meets the credit requirements for views

Project teams are required to provide documentation supporting credit compliance. The following documents may be used to demonstrate compliance:

- **Daylight modelling report** showing the daylight factor or daylight illuminance for the claimed spaces and including the following information:
  - a summary table showing each space or floor, their nominated area, and the compliant area in both square meters and as a percentage basis
  - The daylight model showing the amount of floor area that is compliant, and the daylight values.
- **Tender/As-built drawings** showing:
  - The location of all blinds / shutters
  - any glare control devices
  - access to views
- **Manual calculations** showing:
  - The amount of floor area that is compliant for daylight
  - The amount of compliant area for views
  - The height and length of windows and any area of any skylights
  - The window properties
  - The lines of sight showing that no obstructions exist
  - Any internal features or showing that no obstructions exist externally

Please provide feedback on the technical content of this credit:

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