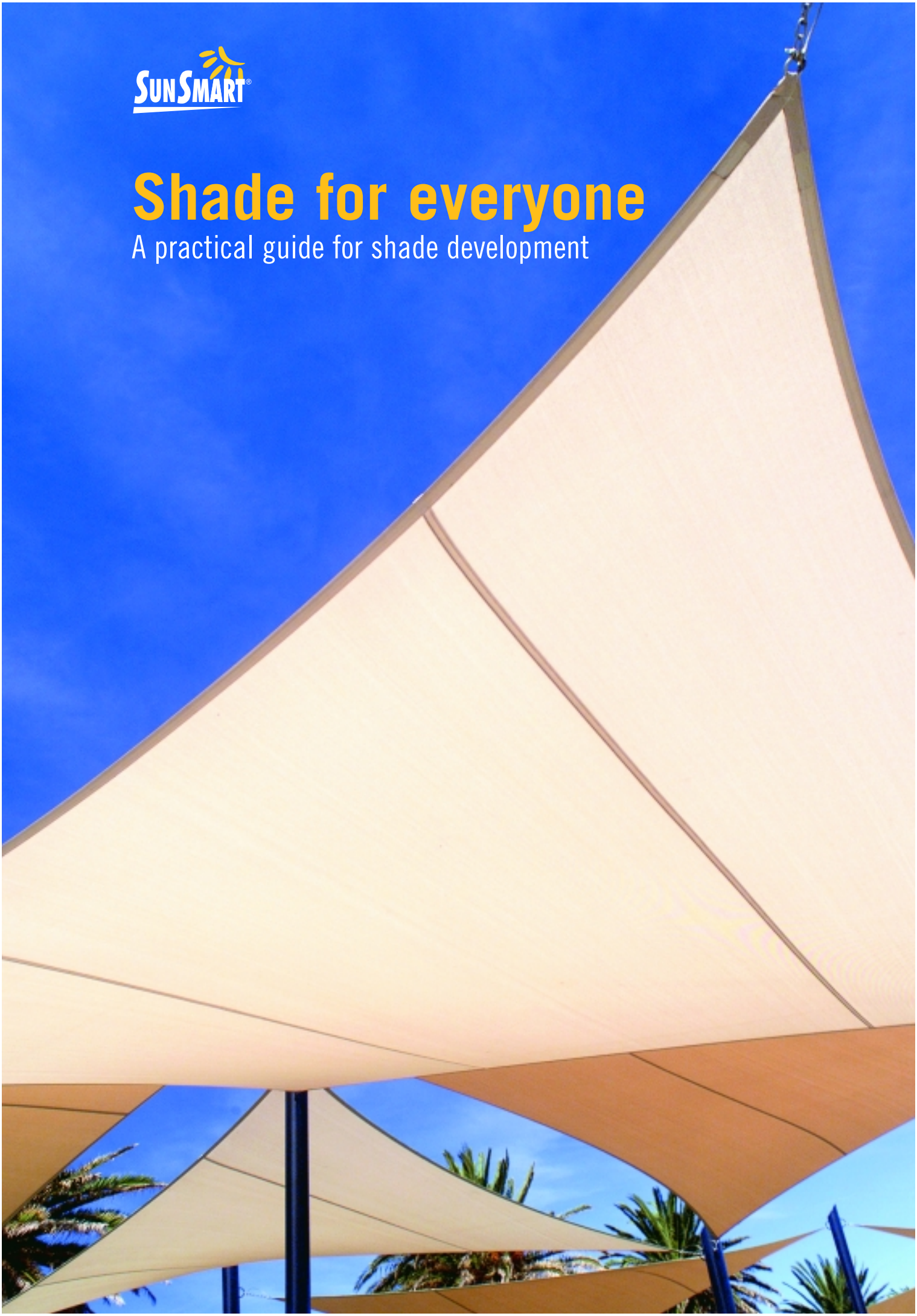
SunSmart®

Shade for everyone

A practical guide for shade development



Acknowledgments

The materials in this resource have been adapted from Greenwood JS, Soulos GP, Thomas ND. *Under cover: Guidelines for shade planning and design.* NSW Cancer Council and NSW Health Department Sydney, 1998.

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Consultation occurred with the following organisations:

- Victorian Department of Human Services
- Victorian Department of Sustainability and Environment
- Local government authorities
- State sporting associations
- Tertiary institutions
- Architects and landscape architects
- Shade manufacturers
- Health agencies
- Early childhood organisations

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About this booklet

Why become concerned about shade?

Australia has the highest rate of skin cancer in the world. Skin cancer is usually caused by over exposure to ultraviolet radiation or UV radiation from the sun. In Australia, sunburn and skin damage can occur in less than 15 minutes on a fine January day. Every year skin cancer costs the Australian health system over $300 million and sadly, despite skin cancer being almost totally preventable, every year it results in the deaths of over 1300 Australians.

Shade provides good protection from the sun and it can be very easy for people to use. Shade alone can reduce overall exposure to the sun's harmful UV rays by about 75% (Parsons et al. 1998). When used in conjunction with sun-protective clothing, hats and sunscreen, shade can be the best route to maximum UV radiation protection.

However, research shows that many outdoor facilities and venues in Victoria have inadequate levels of shade (Dobbinson, Inglis & Hilditch 2003). More shade is needed in public places, so that people can easily make healthy shade choices.

Who is this booklet for?

This booklet is designed to assist individuals and organisations who are planning for good quality shade in community settings such as sporting venues, parks, pools, beaches, schools and child care centres. It may also be of value to individuals wanting to create effective shade in home settings.

Every effort has been made to provide clear and comprehensive information, however, depending on your shade project, you may wish to seek advice from professionals such as landscape architects, architects, engineers and horticulturalists.

If after reading this booklet you have further questions, call SunSmart on 13 11 20 or visit www.sunsmart.com.au

How to use this booklet

This booklet walks the reader through the key steps to take when thinking about shade for outdoor activity sites and planning to undertake a shade project. These include:

Step One: Understanding sun and shade

Step Two: Identifying your shade needs

Step Three: Understanding your shade options

Step Four: Considering built shade

Step Five: Considering natural shade

Step Six: Implementing your shade project

The resource concludes with some information on where to go if you require further information and some useful references for additional reading. In addition, to assist in developing shade in specific settings, seven information sheets are available that cover beaches and foreshores, early childhood centres, parks and reserves, playgrounds, public swimming pools, sports grounds and schools.

Step One: Understanding sun and shade

What is ultraviolet radiation?

An understanding of the sun and in particular ultraviolet radiation and the way it behaves, will assist in planning for creating effective shade. The sun gives off many different types of radiation. As well as visible light (sunlight), there is invisible radiation. One type of invisible radiation is infrared radiation, which provides heat. The other is ultraviolet or UV radiation.

UV radiation is not warm. We can neither see nor feel it, but each time unprotected skin is exposed to the sun, UV radiation causes changes to take place in the body's cells. Over many years, skin becomes permanently damaged and the damage continues to worsen as long as skin continues to be exposed to the sun. If the damage is serious enough, it may result in skin cancer. UV radiation can also cause eye damage.

Everyone knows that you can get sunburnt in summer. But hot summer days are not the only danger time. UV radiation is present in the sun's rays throughout the year in varying amounts. In Victoria, UV radiation levels rise in September and stay high until the end of April.

How does UV radiation from the sun reach you?

UV radiation can reach you on the ground from three sources;

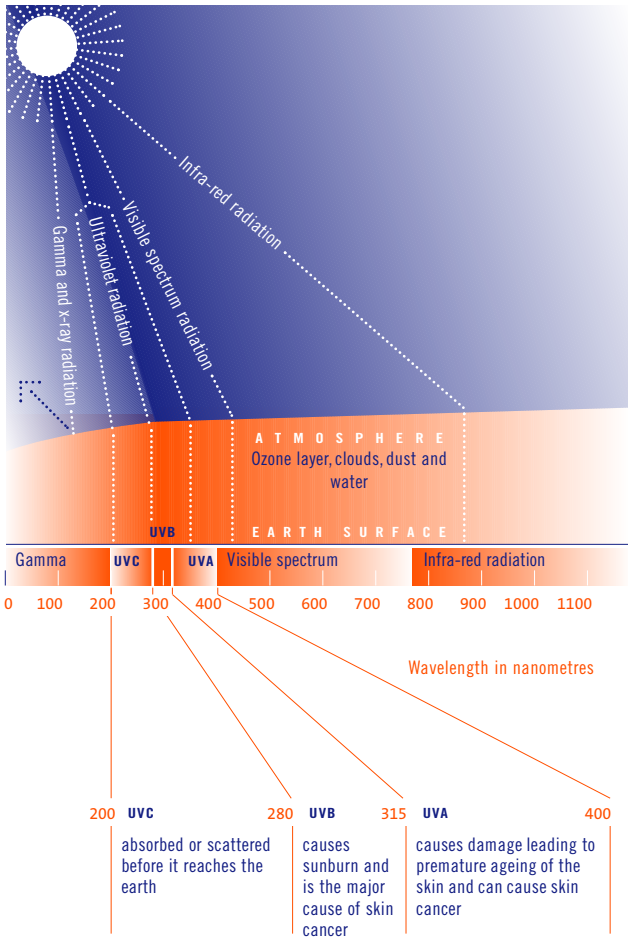
- directly, in a straight line from the sun
- indirectly scattered from the open sky or
- indirectly reflected from surfaces such as walls, concrete and sand.

Even if you are shaded from the direct sun you can still receive considerable UV radiation exposure indirectly. This can be from the open sky and/or from surfaces on the ground that reflect UV radiation.

Indirect UV radiation can reduce the effect of personal sun-protective measures such as hats and shade. For example, a person standing under a shade structure may appear to be shaded but may still be receiving considerable UV radiation from a reflective surface nearby, such as concrete.

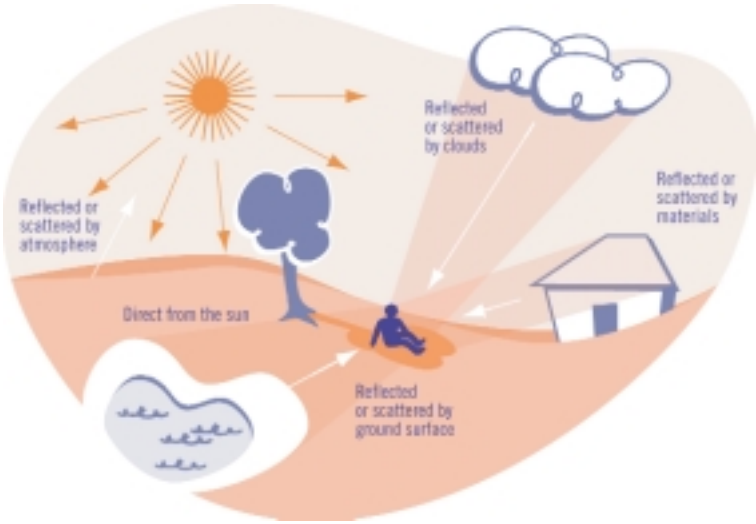
Although indirect UV radiation is generally weaker than direct UV radiation, it can still damage skin and eyes. A mixture of direct and indirect UV radiation will generally result in a higher level of exposure than direct UV radiation alone.

The sun and ultraviolet radiation

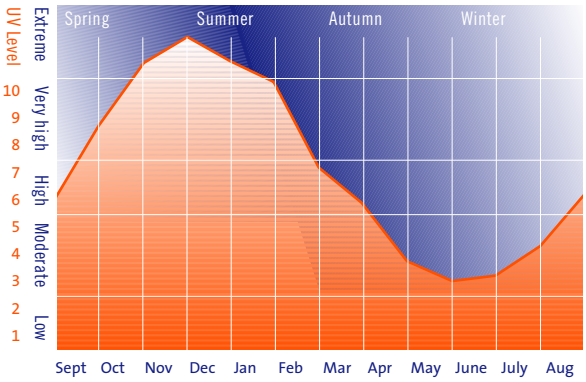


(Source: Australian Radiation Protection and Nuclear Safety Agency 1997)

Direct and indirect sources of UV radiation

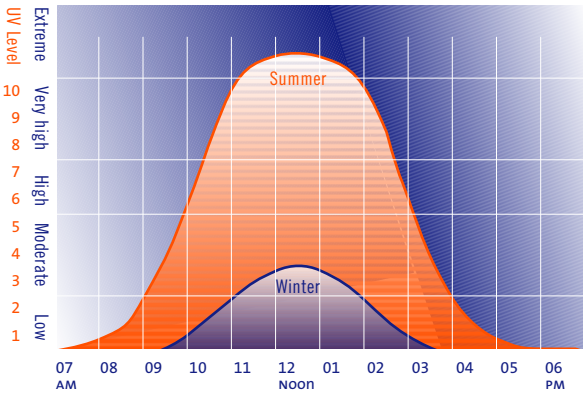


UV intensity in Victoria across the year



(Source: Australian Radiation Protection and Nuclear Safety Agency 1997)

Seasonal variation in UV radiation intensity



(Source: Australian Radiation Protection and Nuclear Safety Agency 1997)

Reflectivity nature of different ground surfaces

Material	Level of reflected UV radiation
Lawn grass, summer/winter	2.0% – 5.0%
Grasslands	0.8% – 1.6%
Soil, clay/humus	4.0% – 6.0%
Asphalt roadway, new (black), old (grey)	4.1% – 8.9%
House paint, white	22.0%
Boat deck, wood/fibreglass	6.6% – 9.1%
Open water	3.3%
Open ocean	8.0%
Sea surf, white foam	25.0% – 30.0%
Beach sand, wet	7.1%
Beach sand, dry, light	15.0% – 18.0%
Snow, old/new	50.0% – 88.0%
Concrete footpath	8.2% – 12.0%

(Source: Sliney 1986)

The ratio of direct and indirect UV radiation varies throughout the day. There is more direct UV radiation when the sun is high in the sky, such as at noon. There is more indirect UV radiation when the sun is low in the sky, such as during the morning and evening or during winter months compared to summer.

What affects UV radiation levels?

A number of factors may affect UV radiation levels during the day and throughout the year. It is important to understand and consider these when planning and building a shade structure.

1. Seasons and time of day: sun height

The main factor that affects UV radiation levels is the height of the sun above the horizon. When the sun is high in the sky, UV radiation has less atmosphere to travel through. Thus UV radiation levels are generally higher in summer when the sun is high in the sky as compared to the winter when the sun is lower. Similarly, UV radiation levels are higher in the middle of the day than in the morning or evening.

2. Scattered UV radiation

When UV radiation passes through the earth's atmosphere, some of it will collide with other molecules and particles. This causes UV radiation to bounce around and change direction. This is called scattered UV radiation. If you are in the shade but can see a lot of blue sky you are still exposed to scattered UV radiation. At times the amount of scattered UV radiation that reaches your skin may exceed that from the direct sun.

3. Reflected UV radiation

Some surfaces can reflect large amounts of UV radiation, including white paint, light-coloured concrete, snow, and water and, to a lesser extent, soil. These reflective surfaces can increase exposure by reflecting more UV radiation onto the skin.

4. Position on earth

The closer you are to the equator, the higher the UV radiation levels. Australia has high levels of UV radiation compared to Europe and North America, due mainly to its position closer to the equator. The earth's orbit also means the southern hemisphere is actually closer to the sun during its summer than the northern hemisphere is during its summer. Locations in the southern hemisphere, including Australia, therefore receive 7% more UV radiation during summer than those in the northern hemisphere.

5. Cloud cover

Cloud cover can affect levels of UV radiation but it depends on the density and type of cloud pattern present. On lightly overcast days the UV radiation level can be similar to that of a cloud-free day and high enough to cause sunburn. Heavy cloud can reduce the strength of UV radiation. When cloud is scattered, levels of UV radiation rise and fall as clouds pass in front of the sun.

6. Ozone

Ozone is a gas that occurs naturally in the earth's upper atmosphere. Ozone absorbs and stops most of the UV radiation from reaching the earth's surface. Ozone levels rise and fall naturally from day to day and seasonally. Ozone over Australia is usually lowest in March. While ozone depletion and related increases in levels of UV radiation are a major environmental issue, other factors, such as sun height and changes in cloud cover, may have more influence locally on the levels of UV radiation reaching the ground.

7. Altitude

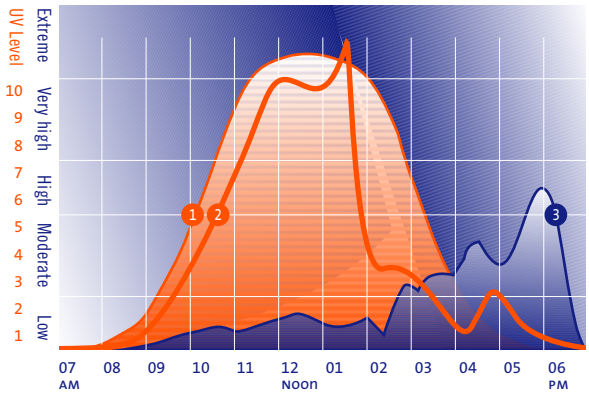
Levels of UV radiation increase by about 4% for every 300m increase in altitude. At higher altitudes there is less atmosphere for the UV radiation to pass through before it reaches the ground, so less UV radiation is absorbed. Locations at higher altitudes can therefore be exposed to more UV radiation than locations at sea level.

The path of the sun and its effect on shade

It is important to understand the sun's path to predict where a tree or shade structure will cast its shadow. The height of the sun relative to the horizon alters with the seasons, thus in summer in the southern hemisphere the sun is more directly overhead and in winter the sun is lower in the sky. The sun also moves continuously across the sky during the day, from rising in the east to setting in the west. Therefore the shadow cast by the sun is also always moving.

It is this constant movement of the sun that makes it difficult to predict correctly where the shade cast by a shade structure or vegetation will fall. For this reason, a lot of shade is incorrectly located and poorly designed, resulting in structures or vegetation that do not provide shade to an area when it is needed most. To ensure your shade lands in the right place, when protection is required, you may decide to seek professional advice. If using a shade designer or supplier, check they are aware of the time of day you need the shade and where you need the shade to land.

The sun and ultraviolet radiation



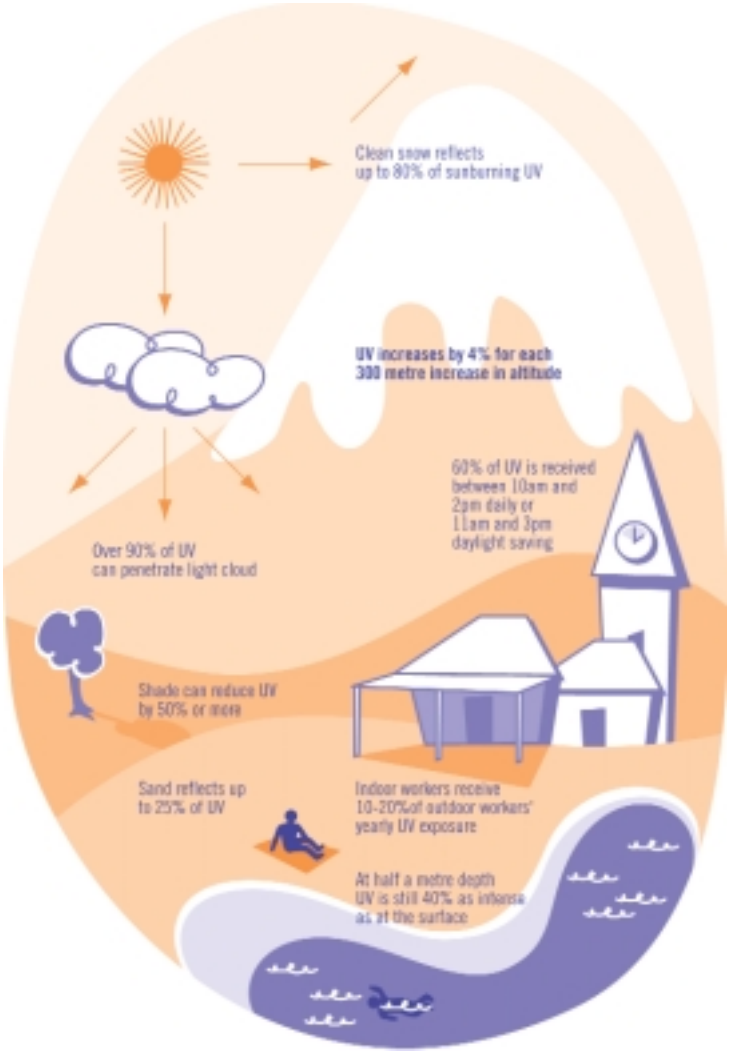
1 Virtually cloudless day. The variation of UVB shows the classic bell-shaped curve.

2 Largely cloud-free until a front moved through in the early afternoon. UVB drop to almost zero.

3 Heavy cloud cover resulting in UVB levels remaining low for the best part of the day.

(Source: Australian Radiation Protection and Nuclear Safety Agency 1997)

Factors affecting UV radiation levels



(Source: Diffey, Larko 1984)

Step Two: Identifying your shade needs

Where should shade be?

Shade is needed in all outside areas where people gather and spend time during the day. Some areas, however, have a greater need for shade than others. This section suggests how to prioritise sites for shade development. Firstly, make a comprehensive list of all sites where shade is important. This will include all sites where any outdoor activity takes place and may include swimming pools, parks, bicycle tracks, and footpaths, playgrounds or sports grounds.

Deciding on the relative priority of several sites

Having identified all potential sites, you should consider each site in relation to the following:

- **Age of users:** Research shows that skin is most in danger of UV radiation damage in the first 15 years of life. Shade is therefore a priority in areas often used by children and young people.
- **Time of use:** In Victoria about 60% of daily UV radiation reaches the earth's surface between the hours of 10am and 2pm or between 11am and 3pm during daylight saving. Sites with high usage during this period have a higher priority for shade. UV radiation levels are also higher during summer; therefore sites that are used a lot in summer have a higher priority. However, use in spring and autumn must also be considered as UV radiation levels rise in September and stay high until the end of April.
- **Duration of use:** The length of time over which the outdoor activity takes place is an important factor in determining priority. The longer the time outside, the greater the risk of over exposure to UV radiation.
- **Level of use:** Sites that have high levels of use should generally take priority over less utilised sites. Well-used facilities with good shade will protect more people more often.
- **Nature of the activity:** The nature of the activity may affect the risk of sunburn among users. Thus sites such as swimming pools, lakes, rivers and beaches generally involve considerable risk of sunburn because of the high levels of reflected UV radiation from water and sand. It is also likely that users will be wearing minimal clothing. In these sites the priority for shade should be high.

Use the *Shade priority checklist* on page 7 to score each site against these key factors. Add up the grand total for each site and compare the final scores. The sites with the highest scores have the highest priority for shade. Lower scores show that shade is still important, but shade provision can be delayed in favour of those sites with higher scores where the priority is higher.

Shade priority checklist

Key factor relating to shade priority	No Never	Sometimes	Yes Always	Overall Score
Age of users:				
• 30% or more of regular users are aged 0-9 years	1	2	3	_____
• 30% or more of regular users are aged 10-18 years	1	2	3	_____
Time of use:				
• Activity at the site is likely to occur between 10am and 3pm	1	2	3	_____
• The site is used over summer	1	2	3	_____
• The site is used over spring & autumn	1	2	3	_____
Duration of use:				
• Activity at the site occurs for 15 minutes or more at a time	1	2	3	_____
Level of use:				
• The site is well used on weekends	1	2	3	_____
• The site is well used on weekdays	1	2	3	_____
Nature of the site and the activity:				
• Users of the setting are exposed to high levels of indirect UV radiation	1	2	3	_____
• Activity at the site is likely to occur in minimal clothing	1	2	3	_____
				Grand Total _____

Studying the shade needs of your selected site

Once you have decided that a site is a high priority for shade development, it is important to study the site in detail to ensure any shade created is placed where it will do the most good. Undertaking a site study not only helps you to identify the site's shade needs, but it will also provide you with the basis of a detailed submission should this be needed to seek funds or organisational endorsement.

Your study of the site should include the following steps:

- **Talk to those involved in the site:** this should include both the people who use the site and those who manage and maintain it. Ask about patterns of use, about existing and potential shade, issues to do with maintenance, and existence of other plans for future use of the site. Remember to record this information.
- **Study the activity patterns of the site:** who uses the site, how do people use the site, at what time of year, at what time of day, for how long, do users protect themselves from UV radiation by other means such as hats, portable shade structures, sunscreen etc.
- **Study the shade patterns on the site:** this involves considering the extent of existing shade structures and how often they are used. Observe, measure and record the way existing shade changes during the day and the seasons. If possible, project shade patterns throughout the year. You may need to employ a specialist professional to do this for you or you may be able to access a computer modelling program to do it yourself.
- **Compare activity patterns with shade patterns:** having identified existing shade, compare it with the site use patterns. You may find there are some other ways of ensuring users of the site are protected. You could, for example, revise 'out-of-bounds' areas, plan activities at different times of day. You could encourage a change in patterns of use to areas of existing shade by relocating seating, drinking taps or play equipment.
- **Draw up a detailed plan of the site:** ensure that this includes the outlines of any building, garden beds, fenced areas, tree locations, car parks, boundaries or other features that affect the shade and use of the site. A site plan should also note the composition of surface materials on the site and in its vicinity that may affect indirect UV radiation. Where shade structures already exist, you may need to make an assessment of their effectiveness, for example trees may be reaching the end of their life, or have grown too tall to provide much shade.
- **Study Steps Three, Four and Five in this document:** this will help you to decide on the specific shade choices for your particular site, and
- **Move to Step Six:** to implement your shade project.

Certain settings, such as sports grounds or early childhood centres, will have different issues that need to be considered when making shade design decisions. Information sheets containing additional information are available on request from SunSmart for the following settings:

- Beaches and foreshore reserves
- Early childhood services
- Parks and reserves
- Playgrounds
- Public swimming pools
- Schools
- Sports grounds and facilities

Step Three: Understanding your shade options

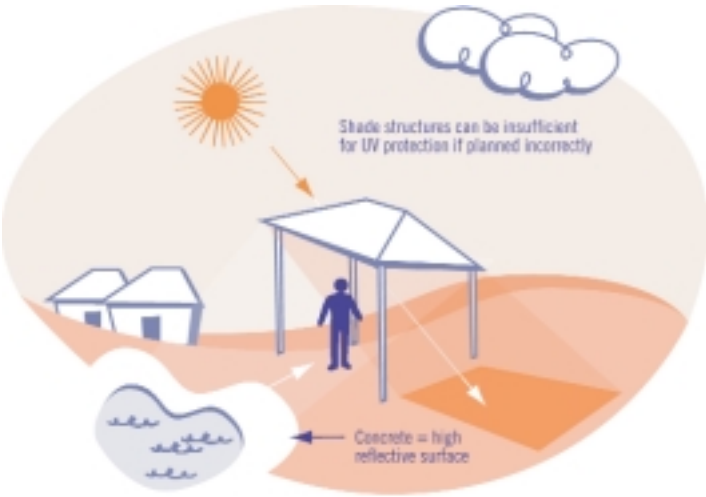
What is quality shade?

Quality shade provides shelter from the sun's UV radiation where it is needed, at the right time of day, and at the right time of year. A well-designed and correctly positioned shade device casts shade where and when it is most needed. The incorrect positioning of shade structures and trees can result in unexpected shadows that provide little shelter from the sun.

Well-designed shade also ensures that:

- the outdoor space is comfortable to use in all seasons
- there is a barrier that protects users from direct and indirect sources of UV radiation, and
- the shade is attractive, practical and environmentally friendly.

Poorly designed shade



Planning shade to fall in the right place at the right time

The direction and length of a shade changes according to the time of day and the time of year. There are three basic daily shade patterns.

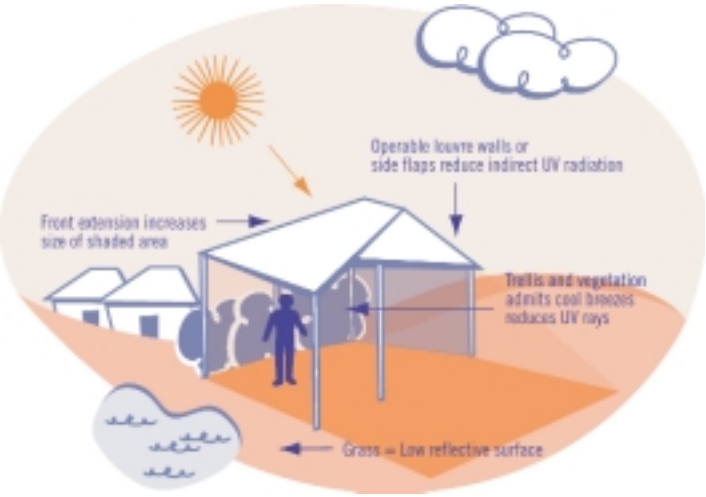
Morning – when the sun is in the east, the shadow will fall in a westerly direction away from the object casting the shadow.

Midday – when the sun is overhead, the shadow will fall close beneath the object casting the shadow.

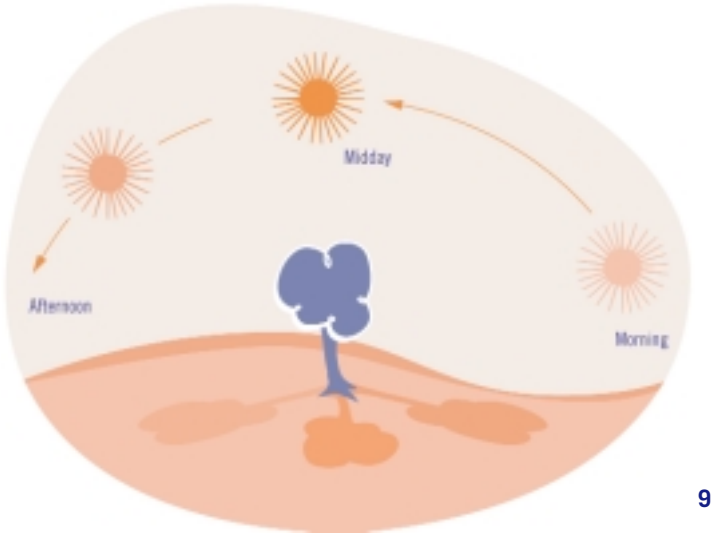
Afternoon – when the sun is in the west, the shadow will fall in an easterly direction away from the object casting the shadow.

It can be difficult to predict where a shade device will cast its shade, especially in a temperate climate where we want to block out the sun in summer for coolness and protection from UV radiation but let it in during the winter for warmth. There are solar charts and computer software available for exact locations, to help develop shade models, but you may wish to seek the assistance of a professional, such as an architect, engineer, landscape architect or horticulturalist.

Well designed shade



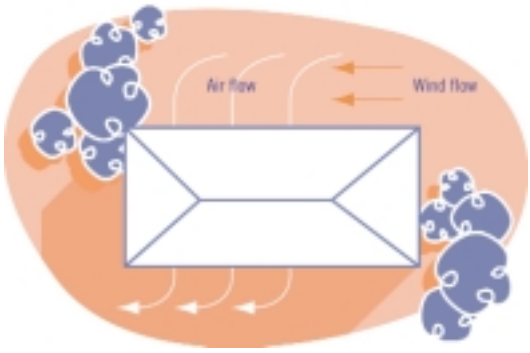
Three daily shade patterns



Ensuring comfort in all seasons

To encourage people to use shade, it needs to be comfortable and attractive. In Victoria, this means providing a cool place in summer and a warm and light place in winter.

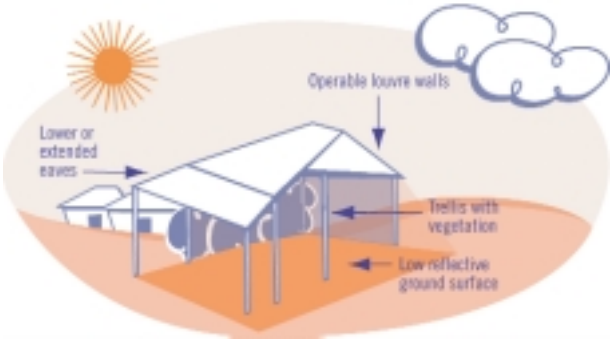
Provide a cool place in summer by:



- Designing the shaded space to capture and channel breezes. For example, orientate openings towards incoming breezes.

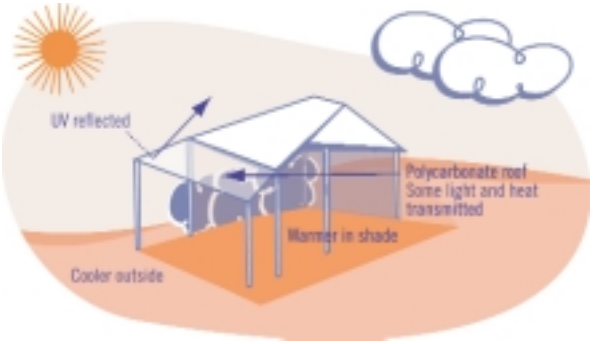
- Providing shade to the openings of built or temporary shade structures. For example, when putting up a marquee, place it so a nearby tree will shade the entrance.

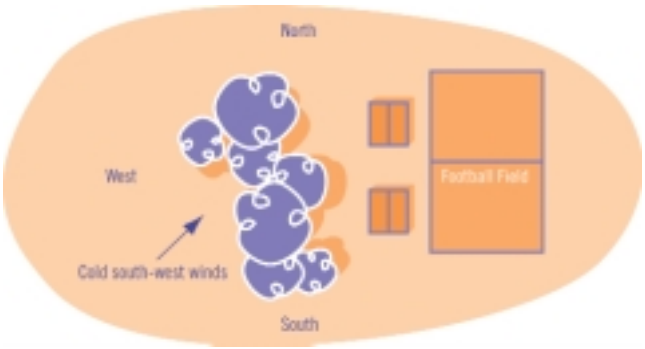
- Adding eaves to the design of built shade. This will cool the space immediately outside your shade structure, which in turn will help your shaded area to be cooler.



- Preventing certain surfaces from heating up, as this can cause the air surrounding these surfaces to become hotter, which may make a nearby shade structure hotter. Shade the surface, change it or select a surface that does not get too hot.

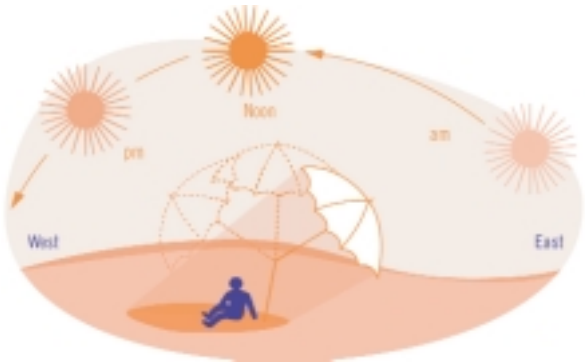
Provide a warm and light place in winter by:



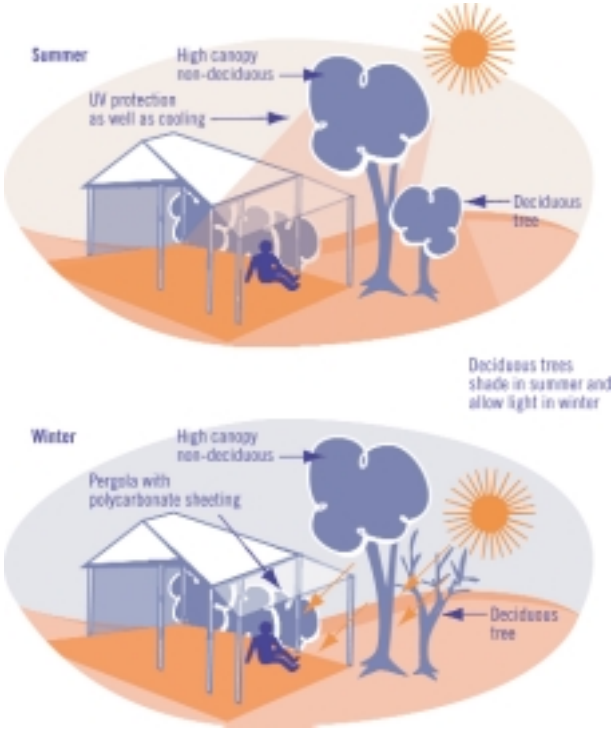


- Providing shade that blocks out the sun's UV radiation but lets in the sun's warmth and light. For example, use see-through shade material.

- Planting windbreaks from the south and south-west to stop cold winter winds.



- Making use of adjustable shade devices.



- Planting deciduous trees and shrubs (trees that lose their leaves in winter) to let in the sun's warmth and light in winter but provide shade during summer.

Reduce the build-up of heat near shaded areas by:

- Limiting areas of solid pavements, bitumen and concrete.
- Using trees to create a feeling of coolness.

Reducing indirect UV radiation

UV radiation that is reflected off surface materials or scattered by clouds or atmospheric particles is called indirect UV radiation. When designing built shade structures, think about the following ways of reducing the amount of indirect UV radiation entering a nearby shaded area.

- Avoid surfaces that are highly reflective. Soft and/or rough surfaces such as brick pavers and grass reflect less UV radiation than hard or smooth surfaces.
- Ensure shade structures are adequate in size. UV radiation levels are greater near the edge of the shaded areas than at the centre.
- Use barriers on the sides of shade structures as well as overhead. Vertical screening such as trellises with plants or louvers can reduce indirect UV radiation while still allowing breezes to flow through.
- Extend overhead barriers past the actual shade areas. A simple rule of thumb is to make sure there is an overhang of at least one metre.
- Change nearby surfaces that are reflective. For example, paint a concrete surface a colour that is less reflective.
- Where possible, plant trees, shrubs and grass near a shade structure, as they help absorb scattered UV radiation.

What shade options are there?

There are two types of shade, built and natural. Decisions about whether to use built or natural shade depend on your specific shade needs as discussed in Step Two: Deciding on your shade needs.

Built shade includes any type of human made structure that creates shade. Built shade lends itself to a range of design options and can often be adapted to the specific needs of a site.

Natural shade includes trees, large shrubs, vines and ground covers that block out direct UV radiation and absorb indirect UV radiation from the sun. Natural shade has the added advantages of cooling and enhancing the visual setting, and providing environmental benefits such as reduced water run-off and improved air quality.

In many situations, using a combination of built and natural shade is best.

The next two sections give details of built and natural shade that will assist you to decide what is the most suitable combination for your site.

Reducing scattered and reflected UV radiation

Step Four: Considering built shade

An overview of built shade

Built shade can be stand-alone or it can be built on to existing buildings or structures. While built shade structures may not always be as attractive as natural shade, their use has some advantages:

- The shade they cast is more predictable.
- They can provide cover from the rain.
- Some types can be erected quickly.

All built shade consists of two parts; the supporting structure which keeps the shade structure in place and holds it up, and the primary shading element, which is the material that makes up the canopy or roof of the shade device.

Some issues to consider in relation to supporting structures and primary shading elements include:

- The supporting structure required will depend on the mass and size of the shading element.
- Solid shade fabrics, which do not allow wind to pass through, require a stronger supporting structure that can withstand a higher level of wind.
- The supporting structure needs to suit the site. For example, in a playground, minimising the number of support structures is important. A primary shading element will therefore need to be chosen to achieve this.
- Your budget must allow for the support structure and shading element. It is not cost-effective to select a cheap shading element if it requires a costly supporting structure.
- The life expectancy of the shade structure should also be considered.
- Where a site is open to the public at all times, the risk of vandalism may need to be considered in relation to the design and location of the built shade.

For all built structures, no matter what the size, it is vital to seek professional advice. Certification from a qualified structural engineer is required for all building applications to ensure structural integrity and safety.

Different types of built shade

Built shade structures are often described using one or more of the following terms:

1. Permanent systems
2. Demountable systems
3. Adjustable systems
4. Tension membrane structures
5. Off-the-shelf structures
6. Portable shade

Shade options

1. Permanent systems

A shade structure is considered permanent if it is designed to last for at least 10 years. Permanent roofing systems need to be durable to withstand the harshest weather conditions. Regular maintenance is essential to ensure their long lifespan. The various parts making up your permanent shade structure should be cheap and easy to replace.

2. Demountable systems

A shade structure is considered demountable if it can be easily put up and pulled down. Demountable systems include portable structures such as large tents and marquees as well as lightweight tension membrane structures.

Demountable systems need to be strong enough to resist wear and tear from frequent transportation and varied use. A strong, durable and easy-to-carry bag is important, as is a place in which to store it. A demountable shade system is practical when:

- A place only needs shade occasionally.
- Temporary shade is needed at different places at the same time.
- A permanent shade structure would not work, given the type of activities that take place at the site.

Demountable systems can have the following advantages:

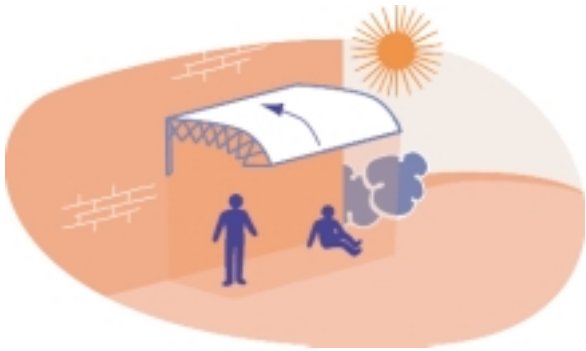
- Some can be adapted for use in a variety of situations, such as above-tiered seating, as well as over large flat surface areas.
- Some demountable systems can be placed on a variety of ground surfaces, such as grass, sand and pavement.
- Some are designed in a modular form that can be extended or contracted depending on the number of people who will need to use it or the space available.
- Walls can be removed depending on the setting and desired airflow.
- Most systems are easy to put up, take down and/or move around.
- The temporary nature of demountable systems mean they are less likely to be vandalised.

3. Adjustable systems

Adjustable systems can range from simple devices through to those that use quite high levels of technology and can be either permanent or demountable. They are often very flexible, allowing the way the shade falls to be changed as the sun moves during the day and at different times of the year.

It is important that adjustable systems are easy to operate. In the event of a storm or in windy weather they may need to be taken down quickly. When buying or making an adjustable system, ensure that parts like pulleys and cables will not rust or wear out quickly. Stainless steel parts are best for such a system.

Adjustable systems are often attached to buildings. They may be a retractable device such as a canvas awning, or a louvered device in the form of a wall or roof.



4. Tension membrane structures

Tension membrane structures (TMSs) are increasingly being used in shade projects and are often referred to as shade sails. They are spectacular looking structures that can be used to provide shade as well as enhance the visual appearance and aesthetics of an outdoor area. TMSs can be permanent or demountable. They usually require minimal support structures due to the combined effect of tension and the curved fabric used in the design. TMSs can be a cost-effective option where shade is required for large areas that need few columns, such as over swimming pools, playgrounds and tennis courts. For small areas, pre-made, off-the-shelf TMSs may produce good results, provided the item is of good quality and that care is taken with orientation.

Some important points to think about include:

- The quality of the tension membrane structure in terms of how protective and durable it is, relates directly to the cost.
- The curve of the fabric affects how strong the structure will be.
- The curve of the fabric affects where the shade will fall. If more than one curved structure or sail is used in combination, they need to be carefully oriented to ensure protection from UV radiation.
- Care needs to be taken to ensure that the curvature of the TMS is suitable for minimising indirect UV radiation.
- Different types of fabrics are available. Ensure the weight of the fabric is appropriate for the support structure while still providing protection from UV radiation. The table on page 16, *Selecting the right shade material* provides more information on choosing the right fabric.
- Fabric structures may not necessarily be a cheaper solution. Lightweight steel roofing or other shade choices, such as a pergola framework supporting climbing plants, may be cheaper.

The design and construction of tension membrane structures is a very specialised field. Professionals will need to be engaged if you choose this type of shade structure.

5. Off-the-shelf structures

Off-the-shelf structures are built shading systems that are pre-made and ready for installation on any site. Depending on the shade needs of your site, an off-the-shelf structure can offer a cost-effective, readily available shade solution. When you buy an off-the-shelf structure, do your homework. Check if the cost includes installation and compare what is on offer from the various suppliers.

Think about the following:

- Determine your shade needs before contacting suppliers. Shade suppliers may not necessarily offer independent or objective advice. Therefore, their advice about the best type of shade, location and placement may be influenced by a desire to sell you their product.
- Will the off-the-shelf structure provide shade at the right time of day and at the right time of year? How will you ensure it is oriented correctly?
- What is included with the off-the-shelf product? Is it the shading element only or does it include supporting structures?
- If purchasing the shading element only, how will the shade be supported at the site? If using existing structures, such as outside walls or verandas to support the shade, you will still need to seek professional advice and get certification from a qualified structural engineer to ensure safety and structural integrity.
- Is the structure suitable to the activities that take place at the site?
- Is the structure big enough for the number of people who will be using it?
- Ask to see test results on how effective the material is at blocking UV radiation (see Appendix I The ultraviolet protection factor).
- Ensure a qualified structural engineer certifies the structure.
- Inspect examples of previous work done by the supplier and talk to previous clients about how the product has performed over time.
- Is the contract for supply only or supply and installation? If the contract is for supply and installation, ensure the price includes engineering certification of the installed structure. If the contract is for supply only, who will install the shade and are they capable/qualified? Remember, certification will still need to be obtained from a qualified structural engineer.

6. Portable shade

Portable shade is ideal for places where other shade options are not available, such as on the beach. These structures provide a quick and often cheap solution to a shade problem. There is a wide range of portable shade structures available in many different sizes, shapes and designs including small tents, beach cabanas and umbrellas. While portable shade can be ideal for individuals or a small group in certain situations such as on the beach, it generally offers limited protection from indirect UV radiation.

For further information on portable shade contact SunSmart on 13 11 20 or visit the SunSmart website www.sunsmart.com.au for the fact sheet Portable shade - tips for purchase and use.

Selecting the right shade material

Below are some basic guidelines to assist in selecting shade materials.

Guidelines for selecting shade materials

	Glass	Polycarbonate and fibreglass sheeting	Canvas or other tightly–woven cloths	Knitted polyethylene or woven PVC shadecloth	Timber	Steel roof sheeting
Suitability	Good windbreak where visibility and light are required.	Roofing, walling louvre, awnings, skylights, canopies.	Good for small, low–budget jobs.	Canopies and other proprietary products.	Pergolas, trellis screens.	Roofing, walling. Steep or low pitches.
Approximate ultraviolet protection factor *– See appendix 1*	Depends on thickness. Ordinary window glass is not highly protective. Some radiation (UVA) penetrates glass.	Very high.	Very high when new.	Shade cloth rating of 90% gives only medium UV radiation protection. Double knits or double layers may give higher protection.	Very high. Direct barrier to UV radiation.	Very high. Direct barrier to UV radiation.
Waterproof	Yes.	Yes.	Yes, watertight up to saturation point.	Porous, lacks rain protection.	Depends on detailing and use.	Yes.
Light transmission	High, depending on tint.	High, but varies according to thickness, profile and colour.	Light colours allow more light.	Lighter colours allow more light but reflect and scatter more UV radiation.	Depends on detailing.	No light transmission.
Solar heat gain	Less heat gain if tinted.	High.	Dark colours hotter.	Darker colours are hotter but reflect less UV radiation.	Does conduct heat.	High if not insulated.
Structural implications	Need to select glass appropriate to the site.	Need to incorporate wind uplift considerations into design.	Guy ropes (if present) can cause obstruction.	Wind drags through porous material.	Need to incorporate wind uplift considerations into design.	Need to incorporate wind uplift considerations into design.
Ease of replacement of sheeting	Usually readily available.	Readily available.	Readily available.	Readily available. Cost is directly proportional to quality.	Readily available.	Readily available.
Life span	Long, if does not sustain impact.	About 10 years. Discolouration may occur sooner.	Limited. Susceptible to breakdown due to UV radiation exposure.	5–10 years.	Long life if well maintained.	Long life if well maintained.
Particular properties	Safety glass available.	Long lengths and range of colours and profiles available.	Range of colours.	Easier to fabricate than solid fabrics. High–stretch. Curved surfaces easily formed.	Available in wide range of sizes and strengths.	Strongest of roofing and walling available. Economic for small to large structures and range of surfaces.
Maintenance requirements	Needs regular cleaning.	Low maintenance. Impact resistant.	Without specific treatment is not mould resistant.	Susceptible to mould growth and dirt accumulation.	Guard against termites.	Subject to moisture and condensation conditions.

Step Five: Considering natural shade

An overview of natural shade

People intuitively associate trees with shade. It therefore makes sense to place a high priority on using trees and plants to provide shaded areas. Where possible, include vegetation in all shade projects. Trees and other plants can provide benefits besides shade, and make your outdoor space more appealing to people. Natural shade is particularly well suited to large recreational areas such as parks and beach reserves.

In many situations, using a combination of built and natural shade is the best option. Whilst vegetation such as trees, shrubs and climbing plants can provide shade, they have some disadvantages. The slow-growing nature of vegetation, maintenance issues and a degree of unpredictability in shade outcomes (because of seasonal variations and plants growing differently in different locations) must be allowed for in the design stage. Maintaining natural shade at a site must also include a planned replacement program. This will be determined by the lifespan of the vegetation used.

How well vegetation shades a space, and therefore how much protection from UV radiation it provides, depends on the density of the foliage. As a general guide, trees with a canopy that is dense (few gaps) and closer to the ground provide better protection from direct UV radiation. The size of the canopy is also an important consideration with larger canopies offering greater protection from direct and indirect UV radiation. Trees with larger canopies will tend to be umbrella shaped rather than tall, narrow and column shaped.

It is very important to choose plants that are suitable to the landscape as well as the local site conditions. In many cases, deciduous trees may be more desirable as they allow light and warmth in winter. Carefully chosen vegetation can make an area more attractive and reduce the air temperature by up to 30% in summer.

The advantages of natural shade

- Plants make an area more aesthetically pleasing for users. They provide seasonal variation in perfume, colour and sound as well as attractive flowers, bark and foliage.
- Using vegetation for shade can have a number of environmental benefits such as providing habitat for local wildlife, absorbing carbon dioxide in the atmosphere and enriching the soil.
- Plants may provide educational opportunities. For example, weeping trees make great creative and shaded play spaces for children.
- Plants can be used to screen unwanted views and provide privacy.
- Plants can provide protection from the wind.
- Carefully chosen trees can cool an area by reducing the air temperature in summer by up to 30%.

Some issues to consider when providing natural shade

- Planting should be consistent with the character of the surrounding environment (natural and built). Consider the townscape character, cultural heritage and landscape identity of your location.
- Local conditions such as soil type, climate and salinity will influence the type of plants that will be suitable for a given site. Seek advice about local conditions before selecting plants for a site.
- Is the size and shape of the plant when it is fully grown appropriate to the space available?
- Avoid plants that are toxic, attract bees, drop limbs, have thorns or spikes and /or are known to cause adverse health effects such as asthma and skin irritation, especially if children are the main users of the site.
- A large number of common garden plants are considered to be very harmful to children. The following list includes only those that are large enough in size to be considered for shade purposes. Avoid plants with the common name of angel's trumpet, rhododendron, black locust, cotoneaster, duranta, oleander, rhus and white cedar. Sweet pea should also be avoided when choosing a climber.
- Avoid trees with invasive roots that may become a problem for nearby buildings, paths and drains.
- Consider whether deciduous or evergreen plants are more suitable. Deciduous plants are ideal for sites where you want winter sun. Evergreen plants are ideal for sites where screening is needed.
- Is the plant a known environmental weed or does it have the potential to spread rapidly and become a weed problem on the site? Check with your local council or the local office of Greening Australia Victoria, the Department of Sustainability and Environment or Parks Victoria.
- Take care not to use trees or plants that will obstruct thoroughfares or create tripping hazards.
- Be aware of overhead powerlines and underground services.
- What are the watering and ongoing maintenance needs of vegetation? Is there an adequate water supply, a need to prune often, mow lawns or fertilise regularly?

- What is the lifespan of the vegetation? To ensure that the natural shade at your site is ongoing, you will need to have a plan for replacing old and dying vegetation.
- Does the tree or plant produce any fruit, berries, nuts, seeds or flowers that may create a slipping or tripping hazard when they fall on surrounding surfaces?
- Are native plants an option? Local native plants are often best adapted to your site conditions. Where a site adjoins a natural waterway or nature reserve, local native plants should be used. However, in some situations non-native or exotic species may be the most appropriate selection (for example, native plants would be out of character in an urban park or sports ground which only has exotic trees).

Seeking professional assistance

A number of trees and shrubs may already be located at your site and it is often a good idea to involve a qualified arborist to assess their condition before incorporating them into a new shade design. It will not be cost-effective to locate new picnic facilities or a playground under a tree that has rotting branches.

Seek advice before lopping or pruning a healthy or young tree. Incorrect pruning, while cheap and easy to do, may actually result in the tree growing with an unsafe branching structure that is more likely to drop limbs. Any cuts to branches over 10 mm in diameter should be undertaken by someone with formal training to ensure the health and integrity of the tree. Pruning trees and other vegetation may also require permits and approval, so check with your local council.

Assistance from engineers should also be sought if using climbing plants on a built structure. Engineers will ensure the structure is safe in windy conditions.

What to look for in a shade tree

In choosing a shade tree or trees for your site you should consider the following:

- The size of the canopy of a shade tree is an important consideration. The larger the canopy diameter, the greater the opportunity for protection from direct and indirect UV radiation.
- In general, trees or shrubs with a canopy that is closer to the ground provide better shade. Therefore, select plants with low branches for better protection. Trees with taller canopies can be planted in groups or rows to improve shade provided.
- Consider the density of the foliage and leaf size. Generally, the larger the leaf size and the more dense the canopy, the better the shade created.
- Foliage and timber block direct UV radiation, but gaps in the canopy will allow UV radiation to penetrate.
- Trees with horizontal branches will provide better shade than trees with branches that are more vertical.
- Native trees such as eucalyptus offer somewhat limited protection from UV radiation as their canopies are not sufficiently dense to provide good protection. However, there are many broad-leaved native trees that can be used to provide more dense shade. Use the above points to identify native vegetation that offers the best protection.
- If eucalyptus are to be used, select species that have a branching structure more suited to providing shade, for example, the spotted gum. When planted in groups, the shade provided is improved. Eucalypt trees regularly checked by arborists and pruned only by professionals are less likely to have problems with dropping limbs.
- Plant groups of trees together to increase the overall size of the canopy and therefore increase the protection provided.
- Combine fast-growing shade trees and shade structures (such as pergolas) with slower-growing large trees.
- Dense shrubs can also provide shade. Pruning shrubs on the underside allows shade areas to be created underneath. A permit may be required before pruning (check with your local council).

The *Shade tree chart* on page 19 provides information to help you select trees appropriate to your site. Remember that conditions vary from site to site and from area to area. The chart lists shade trees but you should also ask advice from local professionals such as qualified horticulturalists, landscape architects or a local nursery. Locally produced references or species lists are also an excellent source of information and can often be obtained from your local council.

Shade tree chart

Botanical name	Common name	Average height & width	Coastal	Frost resistant	Heavy soils	Quick growing	Wet soils	Canopies	Clean trunks	Invasive roots	Shallow roots	Light limb droppers	Deciduous
Area A – Cool Mountainous													
ACER negundo aurea variegatum	Silver Wattle	7-14m x 5m		X	X		X	X		X			X
ACER truncatum x Acer platanoides	Norwegian Sunset (Norwegian Sunset Shantung Hybrid Maple)	10m x 6m		X	X			X	X				X
ACACIA implexa	Hickory Wattle	5-15m x 5m		X	X			X	X				
ACACIA melanoxylon	Blackwood Wattle	9m x 7m		X	X		X				X		
ACACIA prominens	Golden Rain Wattle	7-9m x 6m		X	X	X					X		
BETULA pendula	Silver Birch	10-15m x 4m		X	X		X	X	X	X			X
EUCALYPTUS linearis	White Peppermint	7-12m x 5-7m		X	X	X		X	X				
EUCALYPTUS nicholi	Willowleaf Peppermint	8-12m x 8m		X	X	X		X	X				
EUCALYPTUS obliqua	Messmate	30-45m x 30m		X	X			X	X				
EUCALYPTUS pauciflora	Snow Gum	4-9m x 6m		X	X		X	X					
EUCALYPTUS scoparia	Wallangara White Gum	9m x 7m		X		X		X	X				
PYRUS calleryana	Callery Pear	8-15m x 4-8m		X	X	X	X	X	X				X
ULMUS parvifolia	Chinese Elm	15m x 12m		X	X	X		X	X				X
ULMUS procera 'Louis Van Houtte'	Golden Elm	10-15m x 8m		X	X		X	X	X	X			X
Area B – Northern Victoria													
ACACIA implexa	Lightwood	5-15m x 5m		X	X			X	X				
ACER argenteum variegata	Silver Variegated Maple	6-8m x 6m		X	X		X	X		X			
ALLOCASUARINA torulosa	Rose Sheoke	4-7m x 3m	X	X	X								
ANGOPHORA floribunda	Rough Barked Apple	12-24m x 12-18m	X				X	X	X				
EUCALYPTUS calophylla rose	Marri	7-10m x 9m			X			X	X				
EUCALYPTUS cornuta	Yate	8m x 8m	X		X			X	X				
EUCALYPTUS leucoxylon rose	Pink Flowering Yellow Gum	5-9m x 5m	X	X	X	X		X	X			X	
EUCALYPTUS macrandra	Long Flowered Marlock	4-7m x 6m		X	X	X	X	X	X		X		
EUCALYPTUS sideroxylon	Red Ironbark	9m x 8m		X	X		X	X				X	
EUCALYPTUS steedmani	Steedman's Gum	4m x 3m	X		X			X	X				
EUCALYPTUS stricklandi	Strickland's Gum	7-9m x 5m	X	X	X								
EUCALYPTUS torquate	Coral Gum	4-7m x 3m	X			X		X	X				
MELALEUCA linarifolia	Snow in Summer	5-10m x 3-6m		X	X	X		X	X	X	X		
MELALEUCA styphelioides	Prickly Paperbark	7-10m x 5m	X	X	X		X	X	X	X	X		
MELIA azedarach	White Cedar	6-12m x 6-10m		X	X	X		X	X	X	X		
PYRUS calleryana	Callery Pear	8-15m x 4-8m		X	X	X	X	X	X				X
SCHINUS molle	Peppercorn	8-15m x 8-12m			X			X	X	X	X		
ULUMUS parvifolia	Chinese Elm	15m x 12m		X	X	X		X	X				X
Area C – Southern Victoria													
ACACIA implexa	Lightwood	5-15m x 5m		X	X			X	X				
ACACIA prominens	Golden Rain Wattle	6-9m x 6m		X	X	X		X	X		X		
ACACIA pycnantha	Golden Wattle	9-12m x 6m			X	X					X		
ACER truncatum x ACER platanoides	Norwegian Sunset (Norwegian Sunset Shantung Hybrid Maple)	10m x 6m		X	X			X	X				X
AGONIS flexuosa	Willow Myrtle	4-7m x 5m	X					X	X	X			
ALNUS jorullensis	Evergreen Alder	7-10m x 5m				X	X	X	X	X			
BANKSIA integrifolio	Coastal Banksia	7-15m x 5m	X		X				X				
EUCALYPTUS calophylla	Marri	7-10m x 9m	X		X			X	X				
EUCALYPTUS lehmanni	Bushy Yate	5-8m x 6m	X		X	X		X	X				
EUCALYPTUS leucoxylon	Yellow Gum	5-9m x 5m	X	X	X	X		X	X			X	
EUCALYPTUS leucoxylon 'rosea'	Pink Flowering Yellow Gum	5-9m x 5m	X	X	X	X		X	X			X	
EUCALYPTUS maculata	Spotted Gum	9-45m x 16m	X		X	X		X	X				
EUCALYPTUS nicholi	Willowleaf Peppermint	8-12m x 8m		X	X	X		X	X				
EUCALYPTUS sideroxylon	Red Ironbark	9m x 8m		X	X			X	X		X		
EUCALYPTUS scoparia	Wallangara White Gum	9m x 7m	X	X		X		X	X				
EUCALYPTUS spathulata	Swamp Mallet	4-7m x 7m	X	X	X		X	X	X				
LOPHOSTEMON confertus	Queensland Brush Box	10m x 15m			X	X	X	X	X	X	X		
MELALEUCA linarlifolia	Snow in Summer	4-8m x 5m	X	X	X		X			X			
MELALEUCA styphelioides	Prickly Paperbark	7-10m x 5m	X	X	X		X	X	X	X	X		
PLATINUS orientalis	Plane Tree	10-15m x 10m		X	X	X		X	X	X			X
PYRUS calleryana	Callery Pear	8-15m x 4-8m		X	X	X	X	X	X				X
TRISTANIOPSIS laurina	Kankooka	8-12m x 8-10m			X	X	X	X	X		X		
ULMUS parvifolia	Chinese Elm	15m x 12m		X	X	X		X	X				X

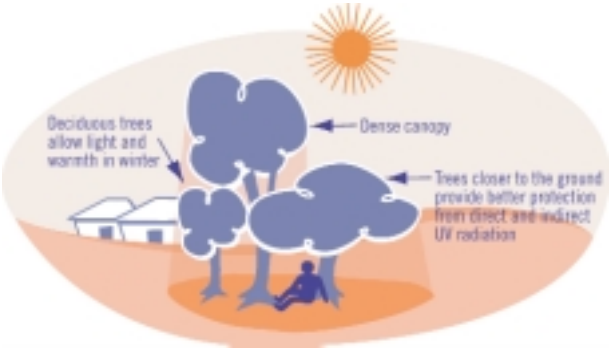
Thanks to the City of Whitehorse for contributing to the Shade tree chart

Purchasing plants

- Purchase shorter, fuller plants rather than tall flowering ones. The fuller plants will become established more quickly than spindly ones.
- In general, younger plants adapt more quickly to new conditions than mature plants, which may have become used to their potted environment. Younger plants are also cheaper.
- Young seedlings that have been kept in the greenhouse or in a well-protected environment such as under shadecloth may need to be 'toughened up' before being planted out. This involves gradually introducing them to natural weather conditions before planting them in their final site.
- Select plants that appear to be healthy and free of disease, pests or signs of stress. Before purchasing, gently tap the plant out of the pot and check the roots. Plants that are pot-bound (causing their roots to become a twisted mass circling the pot) will have difficulty becoming established.
- Read the plant labels. This should provide information about the plant's final size, soil and site requirements, as well as characteristics such as foliage, flowers and seasonal variations. This information should help you to check that it is an appropriate plant for shade and suitable for your site conditions.
- If in doubt, ask for advice from the nursery staff.

Where to plant

- As with built structures, it is important to position your plants to ensure that the shade will fall where it is needed.
- Plant trees to the north and west of where you want shade. This will provide shade from the hot midday and afternoon sun, times when UV radiation is most intense.
- Rows of trees can also be planted in the south/south-west to act as windbreaks.
- Make sure trees are planted at least 3 m from buildings, pipes and drains, and well away from powerlines.



When to plant

- Plant trees from autumn to spring.
- Deciduous trees are best planted in winter, when they are dormant.
- Make sure the site and soil are well prepared before planting. Competition from weeds will make it difficult for plants to become established.
- Check the label or seek advice from nursery staff or a plant guide on the best times to plant and maintenance requirements (use of guards, mulching, watering and fertilising) while the plant is becoming established.

Combining natural and built shade

Plants and built shade used together may offer the best shade solution at a site, for example:

- Grow plants onto a built structure, such as a pergola or lattice screen. When choosing a vine, thought should be given to its size and vigour as well as the strength of the supporting structure.
- Ensure plants and built structures complement each other. Built shade structures can protect from direct UV radiation while the vegetation reduces indirect UV radiation and helps cool the space by letting in breezes.
- Combine temporary built shade structures to provide instant shade while waiting for natural shade to grow.

Step Six: Implementing your shade project

Planning your shade project

Good planning is important for any shade project. The degree of planning depends on the size and setting of your shade project, however, there are several steps in the shade planning process that should be taken regardless of the scale of the project.

- Form a project team to develop the project. If possible, include people with skills in areas such as landscape architecture, horticulture, engineering or architecture.
- Involve interested individuals or groups who will benefit from, or will be affected by, the project.
- Understand sun and shade by reading Step One in this document
- Identify your shade needs by working through Step Two in this document. Prioritise your sites needing shade and consider the specific needs of each of the selected sites.
- Draw up a detailed site plan to identify the location of the shade project and of any underground services in the vicinity, the emergency routes or access routes that must be maintained and any constraints on site use such as ground conditions or future plans for the site.
- Decide on the shade options for your selected site or sites by working through Steps Three, Four and Five in this document.
- Undertake cost estimates for the design and implementation of your shade project and explore sources of funding. If investing in natural shade, investigate the cost and feasibility of putting a temporary structure in place until the trees reach maximum shade capacity.
- Prepare a plan for fundraising if necessary and/or appropriate. Ensure commitment from site management and/or supporters, for example, parents, volunteers and sporting participants.
- Investigate skills available within your own organisation. If skilled labour is available, such as carpenters, this is likely to influence the choice of construction method. Check your insurance cover if you decide to use voluntary unskilled labour.
- Identify the permits and documentation that may be required. Building and construction permits are often needed for the erection of built shade structures. The regulations may vary depending on the local council, the setting and the type of construction planned. It is important to consult the building certification and inspection department (or equivalent) at your local council to ensure you comply with building regulations. Pruning trees and other vegetation may also require permits and approvals.
- Determine any external constraints such as heritage issues, environmental impact considerations and surrounding community reaction. Develop a plan to address these.
- Explore timing issues, for example, the project may span a long period from building construction through to tree planting at a much later date. There may be time constraints on construction, such as difficulty in accessing a school site during the school term.

Drawing up a design brief

You will need to draw up a detailed design brief to assist in tendering or undertaking the construction of your shade project. The design brief should include:

- The overall site plan
- Shade needs:
  - the critical UV protection time
  - where and when you would like the shade to fall
  - type of shade preferred - built or natural, permanent or demountable
  - the requirement for rain shelter
  - nature of activities in the vicinity of the project, for example, children at play or vehicle movements
  - special climatic conditions
  - likely security or vandalism issues
  - maintenance needs
  - anticipated shade lifespan.
- Money and labour requirements
  - project budget
  - timetable for the work
  - how the project will be overseen and monitored
  - costs of covering insurance, liability, approval permits etc
  - the availability of in-house voluntary, skilled and/or unskilled labour.
- Timeframe for completion of the project.

Selecting a company to implement your shade project

If you decide to use a specialist company to do all or part of your shade project, it is important to communicate your shade needs and project goals. You do not want the company designing or building something that is too expensive or is inappropriate for your shade setting. The cost of engaging experts such as landscape architects and shade manufacturers needs to be included within your project budget.

In choosing the company to implement your project consider the following questions:

- In the case of built shade, is the company qualified to undertake shade structure construction work such as building a sail type structure? Check that the prospective contractors are Registered Building Practitioners in the field of tensioned structures. A 'Commercial - Unlimited' registration would also be acceptable.
- Does the company's submission include certification by a structural engineer?
- Does the company's submission include the acquisition of permits or approvals?
- Does the company's submission outline relevant standards with which the design must comply?
- What insurance, for example, public liability, is provided?
- Can the company provide you with a list of previous projects and clients who can act as referees?
- Do you receive product warranties upon completion?
- What ongoing services (for example, safety checks, maintenance and cleaning) are offered and what fees are involved?
- What are the specifications of the materials proposed? For example, what is the durability and UV protection factor of the shade material?

Managing your shade project

Where more than one company/supplier has been contracted to provide services for a project, careful co-ordination and management is needed to ensure your project goals are met. All too often, when shade is one part of an overall venue construction or upgrade, budgets can be spent before the cost of shade construction or landscaping is included.

Track the progress of the project by keeping a written record. This will help if the management of the project needs to be handed over to someone else. It is will also assist in the evaluation of the shade project at some future date.

Evaluating your shade project

After your shade project has been completed it is a good idea to evaluate how well it meets the shade requirements of the site and the users. Evaluation will assist in planning future shade projects and can be done using the same approach as described in Step Two: Identifying your shade needs.

Appendix I: The ultraviolet protection factor

The ultraviolet protection factor (UPF) is a scale developed by the Australian Radiation Protection And Nuclear Safety Agency (ARPANSA), formerly the Australian Radiation Laboratory, in consultation with The Cancer Council Victoria to rate the protection provided by clothing materials. The term UPF was chosen to distinguish it from the sun protection factor or SPF scheme for sunscreens. A material's UPF rating is based on the percentage of UV radiation transmitted through the material.

A standard for sun protective clothing (AS/NZS 4399) was published in July 1996. This standard describes testing methods and labelling requirements for UPF rated clothing. Although the standard applies only to clothing, ARPANSA has stated that for non-clothing items such as tents and umbrellas, it is reasonable to attach a label stating the UPF rating of the fabric as long as it is clear that the rating applies to the fabric only. The UPF rating does not apply to the shade structure. The following table shows the rating system, as it is presented in AS/NZS 4399:1996.

UPF rating	% UV radiation blocked
15–24	93.3–95.9
25–39	96.0–97.4
40 and over	97.5 or more

(Source: Standards Australia 1996)

What affects the UPF of a fabric?

- Different fabrics have different UV radiation-absorbing properties.
- Less UV radiation passes through tightly woven or knitted fabrics.
- Darker colours usually block more UV radiation.
- Heavier weight fabrics usually block more UV radiation than light fabrics of the same type.
- Fabrics that are overstretched, wet or worn out may have reduced UV radiation protection.

UPF and shade materials

As mentioned above, the UPF rating system from AS/NZS 4399 does not in theory apply to non-clothing items such as shade materials. Many manufacturers therefore choose to describe the amount of protection provided against UV radiation using a percentage figure instead. For example:

- If a shade cloth is rated at 50%, it absorbs 50% of UV radiation, transmits 50% of UV radiation and has a UPF of 2.
- If a shade cloth is rated at 90%, it absorbs 90% of UV radiation, transmits 10% of UV radiation and has a UPF of 10.

The following table, which relates percentage of UV radiation absorbed and transmitted to the UPF rating system, may therefore be more useful when selecting shade cloth. As a rule of thumb, aim for shade cloth that absorbs at least 90% of UV radiation.

% UV Radiation Transmitted	% UV Radiation Absorbed	Ultraviolet Protection Factor	Protection category
10	90	10	Moderate Protection
5	95	20	High Protection
3.3	96.7	30	Very High Protection
2.5	97.5	40	Excellent Protection
2	98	50+	Excellent Protection

(Source: Australian Radiation Protection and Nuclear Safety Agency 1997)

The ARPANSA Information Bulletin on Materials and protection against UVR describes the protection provided by various materials often used for built shade structures including:

- **Shadecloth:** ARPANSA has measured shade cloths with UPF ratings as high as 20 meaning they absorb more than 95% of UV radiation.
- **Awnings:** Most awning materials measured by ARPANSA have UPFs of 50+ and therefore provide excellent protection.
- **Outdoor roofing materials:** Various forms of plastic sheeting are often used to cover outdoor living spaces. There are many different types of plastic and generally plastics absorb UV radiation strongly and provide good protection (Toomey, Gies & Roy 1995). Opaque materials such as aluminium or tin naturally provide excellent protection up to UPF of 50+.

References and further reading

Works cited

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Further reading

Australian Radiation Protection And Nuclear Safety Agency. 2002. *Resource guide for UVR protective products.* Melbourne Australia.

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The Cancer Council Victoria 1997. *Developing shade in public places.* Melbourne: The Cancer Council Victoria.

Where to go for further assistance

Architectural advice and help finding a local architect

Archicentre
530 Glenferrie Road
Hawthorn Vic 3122
Ph: 1300 134 513
www.archicentre.com.au

Royal Australian Institute of Architects, Victorian Chapter
1st floor 41 Exhibition Street
Melbourne Vic 3000
Ph: (03) 9654 8066
Fax: (03) 9650 3360
www.raia.com.au

Information and statistics on skin cancer and sun protection

SunSmart
The Cancer Council Victoria
1 Rathdowne Street
Carlton Vic 3053
Telephone (03) 9635 5148
Facsimile (03) 9635 5260
www.sunsmart.com.au

Cancer Helpline 13 11 20

Contact details for local government

Municipal Association of Victoria
Level 12, 60 Collins Street
Melbourne Vic 3000
GPO Box 4326PP
Melbourne Vic 3001
Ph: (03) 9667 5555
Fax: (03) 9667 5550
www.mav.asn.au

Local Government & Regional Services
L19, Nauru House
80 Collins Street
Melbourne Vic 3000
Tel: (03) 9655 8888
Fax: (03) 9655 6892
Email: local.government@doi.vic.gov.au

Natural shade issues and horticultural/vegetation advice

Australian Institute of Landscape Architects, Victorian Group
1st floor 41 Exhibition Street
Melbourne Vic 3000
PO Box 18025
Collins Street East
Melbourne Vic 3000
Ph: (03) 9650 1898
Fax: (03) 9650 3360
www.aila.org.au/victoria

Greening Australia Victoria, State Office
10 Buckingham Drive
PO Box 525
Heidelberg Vic 3084
Ph: (03) 9450 5300
Fax: (03) 9457 3687
www.gavic.org.au

Your local nursery, local council parks department, local offices of the Department of Sustainability and Environment (formerly Department of Natural Resource and Environment) or Parks Victoria may also be able to assist with vegetation issues and plant selection.

Estimating and measuring shade

Association of Consulting Surveyors, Victoria
Suite 203, 21 Bedford Street
North Melbourne Vic 3051
Ph: (03) 9326 9700
Fax: (03) 9326 9779
www.surveying.org.au

See also architect and landscape architect contacts above

Australian standards relating to UV protection and play equipment

Standards Australia
19-25 Raglan Street
South Melbourne Vic 3205
Ph: 1300 65 46 46
Fax: 1300 65 49 49
Research Services: research@standards.com.au
www.standards.com.au

Relevant standards include:

AS/NZS 4399: 1996
Sun protective clothing - evaluation and classification

AS 4174: 1994
Synthetic shadecloth

AS/NZS 2604: 1998
Sunscreen products - evaluation and classification

AS/NZS 1067.1:2003
Sunglasses and fashion spectacles

AS/NZS 1337: 1992
Eye protectors for industrial applications

AS/NZS 4422: 1996
Playground surfacing - specifications, requirements and test methods

AS/NZS 4486.1 1997
Playgrounds and playground equipment Part 1 - development, installation, inspection, maintenance and operation

Contacts for the design of play spaces for children and children's services

Playgrounds and Recreation Association of Victoria
PO Box 2060
North Melbourne Vic 3051
Ph: (03) 9412 4013
Fax: (03) 9412 4019
www.prav.asn.au

Department of Human Services
Community Care Division
13/555 Collins Street
Melbourne Vic 3000
Email: Community.Care@dhs.vic.gov.au
www.dhs.vic.gov.au

The Cancer Council Victoria

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