SunSmart

Shade Guidelines

sunsmart.com.au

Cancer Council Victoria

VicHealth

Acknowledgements

These guidelines including illustrations and photographs not otherwise acknowledged have been adapted from:

- Cancer Council NSW 2013, *Guidelines to Shade. A practical guide to shade development in NSW*
- Cancer Council Western Australia. 2012, *The Shade Handbook: A practical guide for shade development in Western Australia.*
- *Shade for Everyone: A practical guide for shade development.* Carlton: Cancer Council Victoria; 2004.
- Greenwood JS, Soulos GP, Thomas ND. *Under Cover: Guidelines for shade planning and design.* Sydney: Cancer Council NSW and NSW Health Department; 1998.

Photographs on the following pages are featured courtesy of Outlines Landscape Architecture: 11, 17, 22

Photographs on the following pages are featured courtesy of Queensland Health: 13, 16

Cancer Council 13 11 20

Suggested citation: SunSmart Victoria, 2015, Shade Guidelines, Cancer Council Victoria, Melbourne.

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Contents

About these guidelines

These guidelines can be used by individuals, organisations and local governments wanting to increase availability of quality shade in a range of settings, such as playgrounds, pools, sporting venues, beaches, parks, schools, childcare centres and backyards.

These guidelines will help you to:

- Understand the issues associated with the sun's ultraviolet (UV) radiation
- Understand the issues associated with shade
- Identify your shade needs
- Understand how to conduct a shade audit
- Plan, implement and evaluate a shade project.

Why is shade important?

Australia has one of the highest rates of skin cancer in the world. At least 2 in 3 people who have grown up in Australia will be diagnosed with skin cancer (Staples et al 2006). Each year more than 2000 Australians die from skin cancer (ABS 2013). In 2014, 412 Victorians died from skin cancer (Thursfield & Farrugia 2015). The Australian health system spends more money on the diagnosis and treatment of skin cancer than on any other cancer, estimated at over $500 million each year on non-melanoma skin cancer alone. (Fransen et al 2012)

The major cause of skin cancer is exposure to UV radiation from the sun. With good protection against UV radiation, most cases of skin cancer can be prevented.

Shade is one of the best and easiest ways to protect against UV radiation. Good-quality shade can reduce UV exposure by up to 75% (Parsons et al 1998). When used in conjunction with other protective measures, such as sun-protective clothing, hats, sunglasses and sunscreen, shade is the best way to provide maximum protection against UV radiation.

The provision of shade is also an important component in the design and creation of safe and healthy communities (National Heart Foundation of Australia).

How to use these guidelines

The guidelines provide general information to help you undertake a shade project. There are two parts to the guidelines. Part 1 contains background information about a range of issues relating to UV radiation and the principles of effective shade. Part 2 provides more detailed information to help you plan, implement and evaluate a specific shade project.

Part 1: Understanding sun and shade

The sun's UV radiation and path

What is UV radiation?

The sun emits many different types of radiation. As well as visible light (sunlight) and infrared radiation, which we feel as heat, the sun gives out UV radiation. Unlike sunlight and infrared radiation, UV radiation can't be seen or felt.

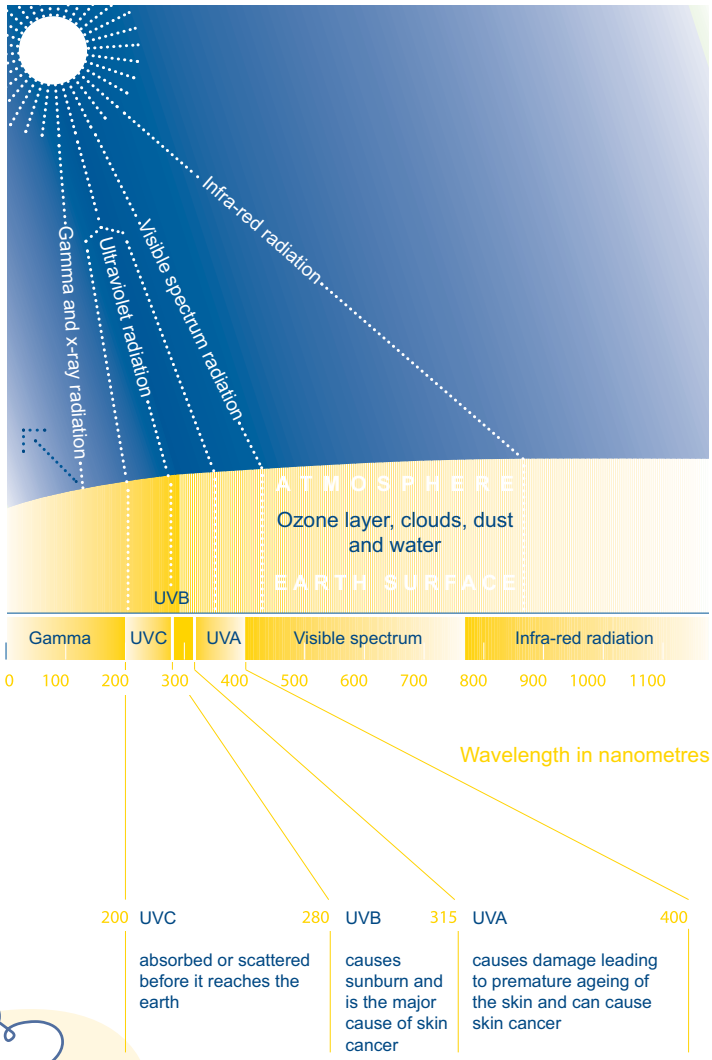
The outdoor temperature does not affect UV radiation levels, which can be high enough to cause damage to skin even on cool or cloudy days.

There are three types of UV radiation:

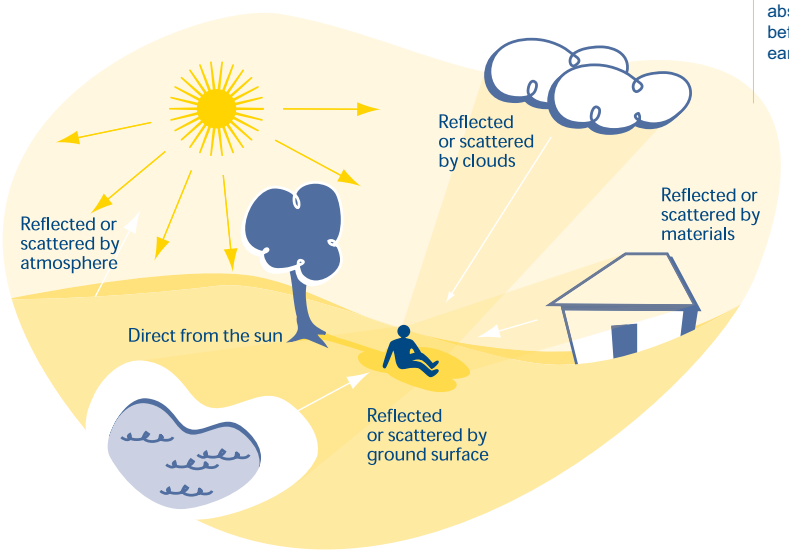
- UVA: transmits freely through the earth's atmosphere.
- UVB: about 15% of UVB transmits through to the earth's atmosphere. The rest is absorbed by ozone.
- UVC: is absorbed by ozone and does not reach the earth's surface.

UVA and UVB both contribute to sunburn, skin ageing, eye damage and skin cancer.

The sun and ultraviolet radiation



Direct and indirect sources of UV radiation



Direct and indirect UV radiation

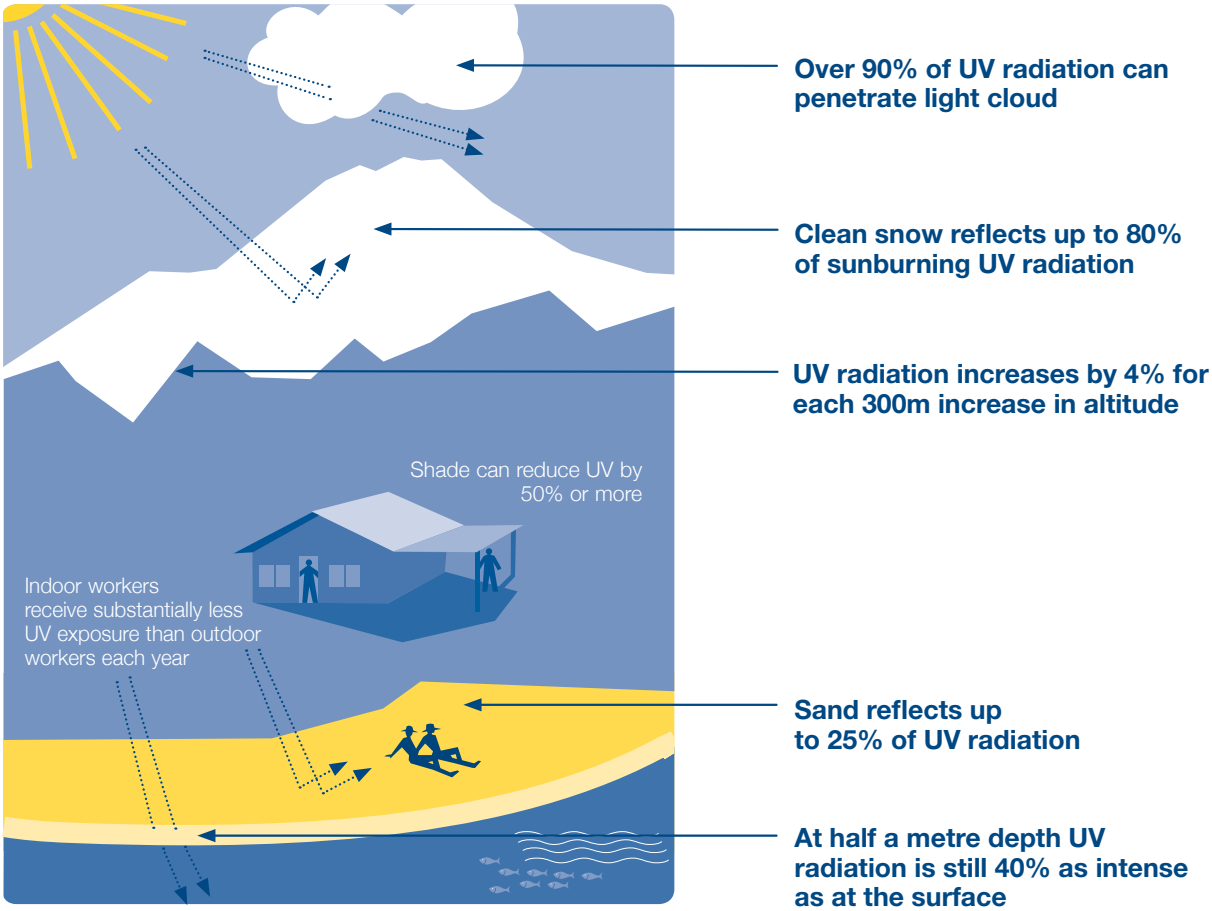
UV radiation can reach you directly, from the sun, or indirectly: scattered by clouds or particles in the atmosphere, or reflected from surfaces such as water.

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.

What affects UV radiation levels?

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

Factors affecting UV radiation levels



Height of the sun above the earth

The main factor that affects UV radiation levels is the position of the sun in the sky. UV radiation is most intense when the sun is directly overhead and UV radiation has the shortest pathway through the atmosphere to earth. When the sun is lower in the sky, the radiation pathway through the atmosphere is much longer, so more UV radiation is absorbed.

Time of day

The amount of UV radiation varies throughout the day. On a cloud-free day, the maximum UV radiation level occurs between 1pm and 2pm during daylight savings in Victoria, when the sun is directly overhead.

Time of year

Generally, UV radiation levels are higher during summer, when the sun is higher in the sky, than in the winter, when the sun is lower.

The ratio of direct and indirect UV radiation varies throughout the day and through the year. 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 with summer.

Scattered UV radiation

When UV radiation passes through the earth's atmosphere, some of it will collide with molecules and particles in the air, and UV radiation is bounced around and scattered. This means that even if you are in the shade, you may still be exposed to scattered (indirect) UV radiation. As a rule of thumb, if you can see any of the sky, you are less than fully protected.

Reflected UV radiation

Some surfaces, such as water, concrete, snow and sand, reflect large amounts of UV radiation. This means that indirect UV radiation may still reach you even if you are in the shade or wearing a hat.

The following table shows the estimated level of reflected UV radiation from a range of common materials.

Table 1: Estimated reflected UV radiation from different surfaces

Material	Percentage of reflected UV radiation
Lawn, grass	2–5%
Grasslands	1–2%
Soil, clay	4–6%
Asphalt road	4–9%
House paint, white	22%
Boat deck (wood or fibreglass)	7–9%
Open water	3%
Open ocean	8%
Sea surf, white foam	25–30%
Beach sand, wet	7%
Beach sand, dry	15–18%
Snow	50–88%
Concrete	8–12%

Source: Adapted from Sliney, 1986

Geographical location

There is more UV radiation in sunlight in the north than in the south of Victoria. In regions close to the equator, the sun is higher in the sky and the sun's rays have a more direct pathway to earth (straight down, not angled) and pass through less of the atmosphere that acts to absorb UV radiation.

Cloud cover

Cloud cover can affect UV levels, depending on the density and type of cloud pattern present. On lightly overcast days, UV radiation levels can be similar to that of a cloud-free day – and high enough to cause sunburn. Thick cloud can reduce UV radiation; however, when cloud is scattered, UV levels rise and fall as clouds pass in front of the sun.

Ozone layer

Ozone is a gas that occurs naturally in the earth's upper atmosphere and absorbs some UV radiation. Ozone levels vary over the year and even across the day. 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.

Altitude

UV increases by 4% for each 300 metre increase in altitude. UV radiation is stronger at higher altitudes because there is less atmosphere for the UV radiation to pass through before it reaches the ground, so less UV radiation is absorbed or scattered.

There is no such thing as 'windburn'. It is actually sunburn. The wind may dry the skin but does not burn it.

Temperature is not an indicator of UV radiation levels. The temperature does not affect the amount of UV radiation reaching the ground. Therefore it is possible to get burnt on a cool and cloudy day.

What is the UV Index?

The UV Index indicates the level of UV radiation that reaches the earth's surface on any given day. The UV Index divides UV radiation levels into: low (1-2), moderate (3-5), high (6-7), very high (8-10) and extreme (11 and above).

The **sun protection times** is a useful tool to identify the hours of each day when the UV Index will be 3 or above - when sun protection is required.

In the example below the sun protection times are from 9:30am to 4:40pm. This means that between these times UV levels will be 3 and above – strong enough to cause permanent damage to most skin types – and sun protection should be used.

You can check UV levels and sun protection times for your area with the **SunSmart app**. Visit **sunsmart.com.au/app** for more information.

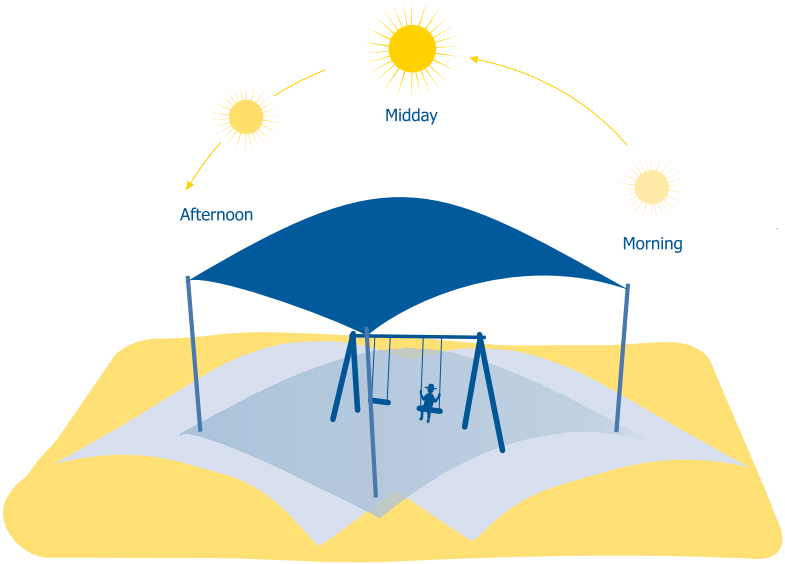
Or look for the **sun protection times** in the weather section of the newspaper or online at **sunsmart.com.au**.

The path of the sun and its effect on shade

It is important to understand the sun's path in order to predict where a tree or shade structure will cast its shadow. The sun moves continuously across the sky during the day, from rising in the east to setting in the west. There are three basic shade patterns every day:

- **Morning** – the shadow falls in a westerly direction away from the object casting the shadow.
- **Midday** – the shadow will be under the object casting the shadow.
- **Afternoon** – the shadow falls in an easterly direction away from the object casting the shadow.

Three daily shade patterns



The height of the sun relative to the horizon also 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.

This constant movement of the sun makes it difficult to predict where the shade cast by a shade structure, tree or other object, such as a wall, will fall. For this reason, a lot of shade is incorrectly located and poorly designed, resulting in built or natural shade that does not shade an area where it is needed most.

To ensure that your shade falls in the right place at the right time, you may decide to:

- Seek professional advice
- Use specialised software
- Conduct a shade audit.

If using a shade designer or supplier, check that they are aware of the time of day you need the shade and where you need the shade to fall.

Understanding your shade options

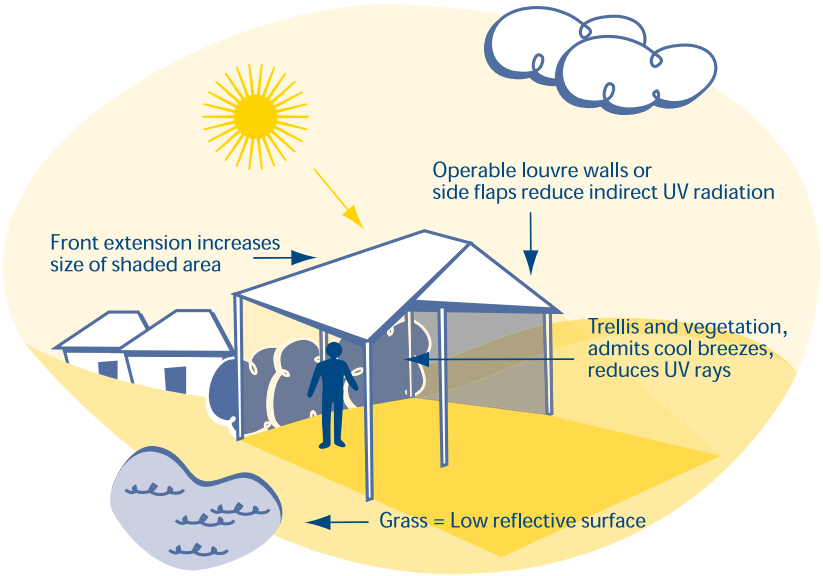
What is quality shade?

Well-designed and correctly positioned shade provides protection from UV radiation where it is needed, at the right time of day and at the right time of year.

Well-designed shade ensures that:

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

Well-designed shade



Climate and comfort

It is important to consider the climate of a location in order to design effective shade.

Shade structures need to be comfortable and attractive in all seasons, so that people will want to use them all year round.

You need to consider four key elements when ensuring a shade structure is comfortable:

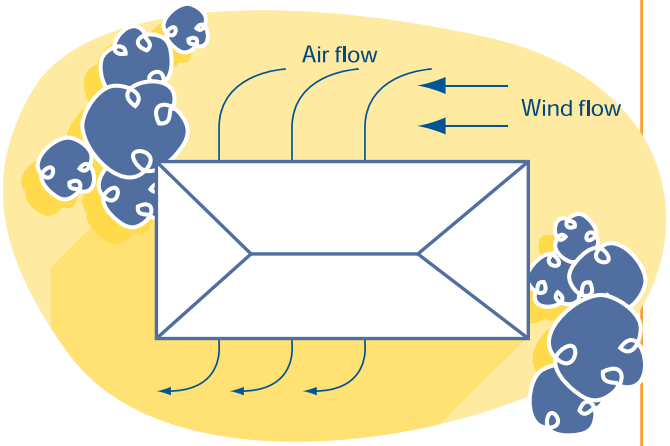
- Air temperature
- Humidity
- Air movement
- Heat radiated from the sun and surroundings.

You can then design the shade structure to best suit your climate.

For example, if it is hot and sticky, provide shade to block out the sun and allow cross-ventilation to capture the breeze for cooling. If it is cold and windy, provide windbreaks to keep out the breeze and use north-facing openings to collect the warmth and light from the sun.

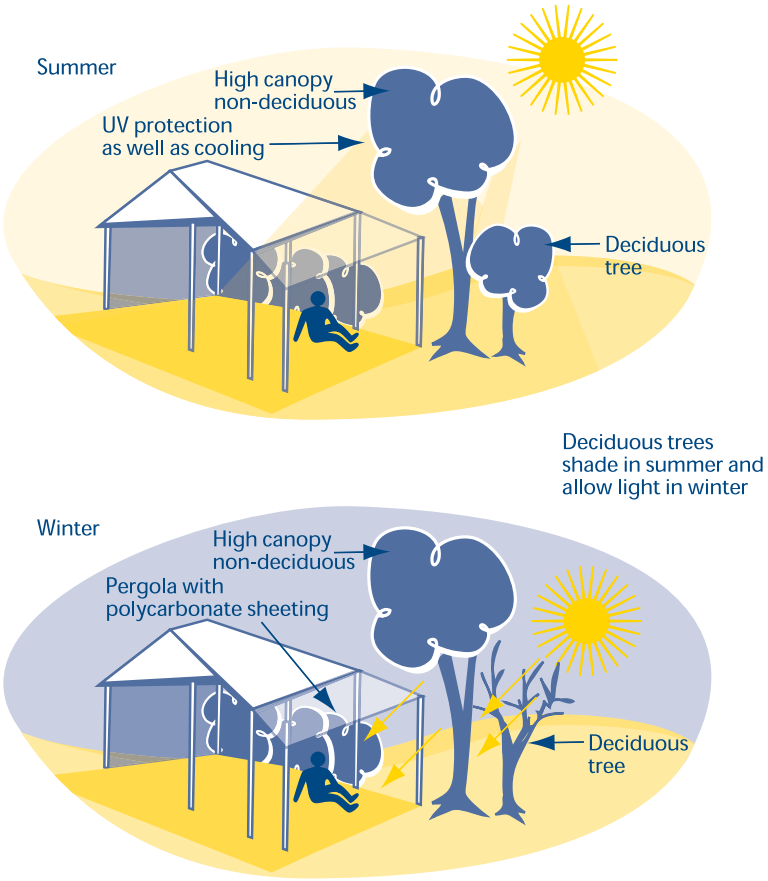
The following methods can be used to provide a cool place when it is hot:

- Design the shaded space to capture and channel breezes. For example, orientate openings towards incoming breezes.
- Provide shade to the openings of shade structures. For example, when putting up a marquee, place it so a nearby tree will shade the entrance.
- Add eaves to the design of built shade. This will cool the space immediately outside the shade structure, which will help the shaded area to be cooler.
- Prevent certain surfaces (such as sand or concrete) from heating up, as this can cause the air surrounding these surfaces to become hotter, which may make a nearby shade structure hotter too. Shade the surface, change it or select a surface that does not get too hot.



The following methods can be used to provide warmth and light when it is cooler:

- Plant deciduous trees and shrubs that lose their leaves in winter to let in the sun's warmth and light in cooler months but provide shade during warmer months.
- Plant windbreaks to stop cold winds.
- Provide shade that blocks out UV radiation but lets in warmth and light from the sun. For example, use see-through shade material.



Reducing direct and indirect UV radiation

The most common method of controlling direct UV radiation is to create a barrier (built or natural) that intercepts the sun's rays, creating shade. Extending overhead barriers past use areas reduces an area's exposure to both direct and indirect UV radiation. Important aspects to consider for such a barrier are as follows:

- **Ensure the shade structure is an adequate size**
  Larger shade structures have more area that is not affected by indirect UV radiation reflecting in from the sides.
- **Consider using barriers for side as well as overhead protection**
  Vertical screening with plants and trellises or opaque louvres can help to block indirect UV radiation, while still allowing breezes to flow through.
- **Extend overhead barriers past use areas**
  A simple rule of thumb is to make sure there is at least one metre of overhang past the actual area of use.
- **Avoid highly reflective surfaces**
  Where possible, choose surfaces that reflect minimal UV radiation. Generally, soft or rough surfaces such as brick pavers and grass reflect less UV radiation than hard or smooth surfaces such as concrete. Depending on the site, it may be possible to change an existing surface that reflects high levels of UV radiation. For example, in a playground, replace asphalt or concrete with rubber matting, which reflects less UV radiation and is also a soft-fall material. If the property next door has a large reflective wall facing your site, you will need to design a shade system that blocks the reflected UV radiation.
- **Consider the arrangement of existing structures**
  For example, if there are a large number of small umbrellas, group them together to form a single larger canopy for greater protection.

Built shade

An overview of built shade

Built shade can be stand-alone, or it can be built onto existing buildings or structures. All built shade consists of two parts: the supporting structure that 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.

Built shade structures have the following advantages over natural shade:

- The shade they cast is more predictable.
- They can provide protection from the rain.
- Some types can be erected quickly.
- They have a range of alternative uses – for example, to collect rainwater for irrigation or to support a solar power 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 stronger supporting structures 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 be determined.
- Where a site is open to the public at all times, the risk of vandalism may need to be assessed 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 may be required to ensure structural integrity and safety. Additionally, to build any permanent shade structure, you will need approval from your local council.

Different types of built shade

Permanent systems

Permanent shade systems are designed to last at least 10 years. Examples include pergolas, verandahs and covered decks. It is important that permanent systems are durable, as they need to withstand all weather conditions. Regular maintenance is essential to ensure their long lifespan. The components of a permanent shade system should be easy to replace.

Demountable systems

A demountable shade structure can be easily put up and pulled down. Examples include tents, marquees and lightweight shade sails.

A demountable shade system is ideal when:

- A site only needs shade occasionally
- Temporary shade is required at different places at the same time
- A permanent structure is not suitable because of the type of activities that take place at the site.

Demountable systems need to be strong enough to withstand frequent transportation, assembly and dismantling. Advantages of demountable systems are:

- Some demountable systems can be used on a variety of ground surfaces, such as grass, sand or concrete.
- Some can be adapted for use in a variety of situations, such as above-tiered seating, as well as over large surface areas.
- Some are designed in 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 and store.
- The temporary nature of demountable systems means that they are less likely to be vandalised.

Adjustable systems

These systems can be modified to provide effective shade as the sun moves during the day and at different times of the year. Adjustable systems are often attached to buildings, and include retractable devices, such as canvas awnings or louvres. Care needs to be taken to ensure structures are correctly and safely installed and that the integrity of the building wall is not compromised.

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

Tension membrane structures (TMS) or shade sails

Tension membrane structures (TMS) or shade sails are increasingly used in shade projects and can be permanent or demountable.

TMS have several advantages: they look good, usually require minimal support structures, and can be cost effective where shade is required for large areas that need to be column-free, such as playgrounds and swimming pools.

For small areas, pre-made, off-the-shelf TMSs may produce good results, provided that the item is of good quality and that care is taken with orientation.

Some important points to consider 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 orientated 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 so ensure the weight of the fabric is appropriate for the support structure while still providing protection from UV radiation. Table 4, ‘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.

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. Before purchasing an off-the-shelf structure, check if the cost includes installation and compare what is on offer from various suppliers. Ensure a qualified engineer certifies the structure.

The design and construction of shade sails is a specialised field. Consult a professional if you are considering this type of shade structure.

Consider the following issues:

- 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 orientated 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 an outside wall or verandah, to support the shade, it is essential that you seek professional advice and certification from a qualified structural engineer, to ensure safety and structural integrity.

- Inspect 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 qualified to do so? Remember, certification will still need to be obtained from a qualified structural engineer.

Portable shade

Portable shade is ideal for places where other shade options are not available, such as on the beach. Portable structures provide a quick and often cheap solution to a shade problem. There is a wide range of portable shade structures available in different sizes, shapes and designs, such as small tents, beach shelters and umbrellas. Keep in mind that umbrellas provide limited protection from indirect UV radiation.

The Ultraviolet Protection Factor (UPF)

The Ultraviolet Protection Factor (UPF) is a scale that rates the protection provided by clothing materials. 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 4399:1996) was published in 1996. This standard describes testing methods and labelling requirements for UPF-rated clothing. Although the standard applies only to clothing, the Australian Radiation Protection and Nuclear Safety Authority (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 the standard AS/NZS 4399:1996.

Table 2: The Ultraviolet Protection Factor (UPF) rating for personal clothing

UPF rating	Percentage of 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 fabrics.
- Darker colours usually block more UV radiation than light colours.
- Heavier-weight fabrics usually block more UV radiation than lightweight 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 4399:1996 does not in theory apply to non-clothing items such as shade materials. Many manufacturers choose to use a percentage figure to describe the amount of protection the material provides against UV radiation. For example:

- If the shadecloth is rated at 50%, it absorbs 50% of UV radiation (and transmits 50% and has a UPF of 2).
- If the shadecloth is rated at 95%, it absorbs 95% of UV radiation (and transmits 5% and has a UPF of 20).

The following table relates percentage of UV radiation absorbed and transmitted to the UPF rating system and may be more useful when selecting shadecloth.

Table 3: Grades and classification of UPF

Percentage UV Radiation Transmitted	Percentage UV Radiation Absorbed	Ultraviolet Protection Factor (UPF)	Protection Category
10%	90%	10	Moderate
5%	95%	20	High
3.3%	96.7%	30	Very high
2.5%	97.5%	40	Excellent
2%	98%	50+	Excellent

Source: Australian Radiation Protection and Nuclear Safety Agency 1997

Good-quality shadecloth is an important part of your shade structure. However, effective shade depends on more than the shadecloth you use. The location of the structure in relation to the area you want shaded, its size and height, and any surrounding reflective surfaces, will all contribute to the quality of shade provided.

Selecting shade material

Table 4: Selecting the right shade material

	Glass	Poly-carbonate/ 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	Pergolas, trellis, screens	Roofing, walling; steep or low pitches
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	Light 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 are hotter	Darker colours are hotter, but reflect less UV radiation	Does conduct heat	High if not insulated
Approximate Ultraviolet Protection Factor (UPF)	Depending on thickness, house window glass can absorb 90% of UV radiation	Very high	Very high when new, lower if material deteriorates over time	Moderate 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
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
Life span	Long life, 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
Maintenance requirements	Needs regular cleaning	Low maintenance. Impact resistant	Without specific treatment is not mould resistant	Susceptible to mould growth and dirt accumulation	Need to guard against termites	Subject to moisture and condensation conditions

* Solar heat gain is an important consideration when selecting shade materials, but it must be remembered that neither heat nor temperature is related to UV radiation levels.

Natural shade

An overview of natural shade

Vegetation is an essential part of shade planning, as it is one of the most effective and attractive ways of providing shade. Where possible, include vegetation in all shade projects. The effectiveness of natural shade depends on the density of the foliage and the size of the canopy. As a general rule, trees with a canopy that is dense and close to the ground provide the best protection from direct UV radiation. The larger the canopy, the greater protection from both direct and indirect UV radiation.

Natural shade has many advantages:

- Vegetation makes an area pleasant for users – plants provide seasonal variation in perfume and colour, as well as attractive flowers, bark and foliage.
- Using vegetation for shade has environmental benefits, such as providing habitat for local wildlife, enriching the soil, and absorbing carbon dioxide in the atmosphere.
- Vegetation can be used to screen unwanted views and provide privacy.

- Vegetation 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

- Ensure that planting will be consistent with the character of the surrounding environment, both natural and built.
- Find out about your local conditions, such as soil type, climate and salinity, before choosing plants.
- Check that the size and shape of a plant when it is fully grown, as well as its lifespan, are appropriate for the space available.
- Avoid plants that are toxic, attract bees, drop limbs, have thorns or spikes, or cause adverse health effects such as asthma and skin irritation. Examples include: angel's trumpet (*Brugmansia* and *Datura* species), *Rhododendron* species, black locust (*Robinia pseudoacacia*), *Cotoneaster* species, *Duranta erecta*, oleander (*Nerium oleander, Thevetia peruviana*), rhus (*Toxicodendron succedaneum*) and white cedar (*Melia azedarach*).
- Contact the RSPCA for advice on plants that may be harmful to pets.
- Avoid trees with roots that may invade nearby buildings, paths and drains.
- Consider whether deciduous or evergreen plants are more suitable. Deciduous plants allow winter sun, while evergreen plants are best when permanent screening is needed.
- Your council website should provide information about plants that are classified as environmental weeds or have the potential to spread rapidly and become a weed problem in your local area.
- Take care not to use trees or plants that will obstruct thoroughfares or create tripping or slipping hazards, such as when berries or seeds fall on the ground.
- Keep large trees away from powerlines and underground services, such as water and gas.
- Consider the costs associated with maintaining natural shade, such as watering, fertilising and pruning.
- Plan natural shade requirements long before starting any construction work.

Selecting shade trees

It is important to consider trees that will suit your area. If you are considering an Australian native (indigenous) tree or an exotic (introduced) species, keep these points in mind:

- How much shade they will create
- Whether they are suited to your climate
- Whether they are suited to the physical conditions of the site, such as soil type and aspect
- How they fit into the landscape character of the setting.

You can ask for advice from local professionals, such as qualified horticulturists, landscape architects or staff in a nursery. Locally produced references or species lists are also an excellent source of information and can often be obtained from your local council.

Purchasing plants

When purchasing your plants, there are some important guidelines to follow:

- Read the plant labels. They should provide information about the plant's final size and soil, site and ongoing care 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 is suitable for your site conditions.
- Purchase shorter, fuller plants rather than tall flowering ones. Fuller plants become established more quickly than spindly ones.
- Choose younger plants: in general, they adapt more readily to new conditions than mature plants. Younger plants are also cheaper.
- Be aware that young seedlings that have been kept in the greenhouse or in a well-protected environment, such as under shadecloth, may need to be introduced to natural weather conditions before being planted out 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.

Talk to nursery staff, who will have extensive knowledge about the plants you are planning to buy, the best time to plant, soil preparation required, optimal planting position, and ongoing care and maintenance of plants.

Combining natural and built shade

Combining natural and built shade, such as growing plants onto a pergola or lattice, has many benefits and is often the best solution for a site:

- Built shade structures protect people from direct UV radiation while the vegetation reduces exposure to indirect UV radiation and helps cool the space by letting in breezes.
- Temporary built structures can be used to provide shade until shade trees mature.

Part 2: Designing and implementing your shade project

Identifying your shade needs

Where should shade be?

Shade is needed in all outdoor areas where people gather and spend time during the day. Some areas have a greater need for shade than others, whether they are in a private backyard or a public park. This first section will help you identify and prioritise sites for shade development. The next section outlines how to plan, implement and evaluate your shade project.

The overall process is outlined in this flow chart:

Conduct a shade inventory to identify all sites where shade is important

Prioritise the sites based on greatest need for shade

Select a site for shade development

Conduct a shade audit to identify the shade needs of the site

Plan the shade project

Implement the shade project

Manage the shade project

Evaluate the shade project

Conducting a shade inventory

The first step in developing a shade strategy is to do an inventory of sites where shade is important. This will include all sites where any outdoor activity takes place. This list should be comprehensive and include such sites as swimming pools, parks, reserves, bicycle and pedestrian paths, public mall areas, early childhood centres, playgrounds, beaches, ovals, school grounds and tennis courts.

If you are building or adding shade to your backyard, list the areas where children play and people regularly congregate. Take into account features that may be fixed permanently in place such as an in-ground swimming pool, and those that may be moved such as play equipment, tables and chairs and BBQ equipment.

Prioritising shade sites

After you've identified all potential sites, assess each site individually using these four criteria:

1. **Time of use**
   UV radiation levels are generally highest between 11am and 3pm during daylight saving (10am and 2pm during the rest of the year). Approximately 60% of the day's total carcinogenic radiation is received between these times. Accordingly, sites most used between these times have a greater need for shade. In Victoria, the UV Index is generally 3 or above for much of the day from September to April. Therefore, sites used extensively in summer have greater priority for shade than those used mainly in winter.
2. **Duration of use**
   The length of time that an outdoor activity requires is an important factor when determining priority. Damage from UV radiation is cumulative, which means the longer the exposure to UV radiation, the greater the risk of harm.
3. **Level of use**
   Sites that have a high level of use should take priority over sites that are used less often.
4. **Nature of the site and the activity**
   Sites such as swimming pools, lakes, rivers and beaches are a high priority, because they generally involve considerable risk of sun damage due to high levels of reflected UV radiation from water and sand, and because activity at these sites is likely to occur in minimal clothing, such as swimwear.

Shade priority checklist

Use the shade priority checklist below to prioritise each site. Score each site against the four factors mentioned above, then add up the total for each site and compare the final scores.

Table 5: Shade priority checklist

Key factor relating to shade priority	No/never	Sometimes	Yes/ always	Overall score
1. Time of use:				
Activity at the site is likely to occur between 11am and 3pm	1	2	3	
The site is used over summer	1	2	3	
The site is used over spring and autumn	1	2	3	
2. Duration of use:				
Activity at the site occurs for 15 minutes or more at a time	1	2	3	
3. Level of use:				
The site is well used on weekends	1	2	3	
The site is well used on weekdays	1	2	3	
4. Nature of the site and the activity:				
Users of the site are exposed to high levels of indirect radiation (i.e. from reflective surfaces)	1	2	3	
Activity at the site is likely to occur in minimal clothing (i.e. beaches/ swimming pools)	1	2	3	
Grand total				

Selecting the site

Sites with the highest scores have a high priority for shade. Shade is still an important issue at sites with a lower score, but they can wait until you deal with the high-priority sites. This prioritising system can be useful when deciding on the budget and timetable.

Conducting a shade audit

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 shade is placed where it will have the most benefit. A shade audit will help you to identify the shade needs of a site and will provide you with the basis of a detailed project brief, which may be used to apply for funds, to gain organisational endorsement, or to engage a contractor.

SunSmart has an online shade audit available at **sunsmart.com.au/shade-audit**.

A shade audit has five steps:

Step 1: Determine the usage patterns of the site.

Step 2: Determine the amount and useability of existing shade at the site.

Step 3: Consider the effects of reflected UV radiation.

Step 4: Assess the need for improved or increased shade at the site.

Step 5: Identify possible options to improve shade at the site.

You will need a copy of a site plan to do a shade audit. The site plan should include the perimeter of the site, an outline of any buildings, and the location of any features that will affect the shade and useability of the site, such as garden beds, trees, fences and car parks.

Remember to include any underground services, as well as emergency or access routes that must be maintained. As you progress through the five stages of the audit, remember to plot any new information onto the site plan.

Critical Protection Time

The Critical Protection Time is the time of day and year when sun protection is most important at the site. UV radiation levels are generally highest between 11am and 3pm during daylight saving, when the sun is closest to being directly overhead (10am and 2pm during the rest of the year). In Victoria, the UV Index is generally 3 or above for much of the day from September to April, and reaches extreme levels in summer. Therefore, sun protection is more important at these times of year.

It is important to assess shade at a site during the Critical Protection Time. It is also advisable to assess the shade at the same time of day on a 'typical' winter day so that summer shade initiatives do not negatively affect winter conditions at the site.

Step 1: Determine the usage patterns of the site

Usage patterns can be obtained by observing users during the Critical Protection Time and also by interviews with users, managers and staff.

Examples of questions you might like to ask are summarised below.

Users of the site:

- What time do you usually arrive to use the site?
- How long do you usually stay?
- How often do you visit the site?
- What areas do you mostly use?
- Do you avoid any shaded areas? If yes, why?
- Is there enough shade?
- How could the shade be increased or improved?

Managers and staff of the site:

- Is the existing shade adequate? If not, how can available shade be increased?
- Is there a need to move activities to make better use of existing shade?
- Is there a need to reschedule activities to avoid peak UV radiation times?
- Do you know of any future plans for the site or the general area?

Some points to consider at this stage:

- Identify the main outdoor activities at the site; as well as when and where they occur.
- Identify the time of year the site is most in use.
- Identify the time of day the site is most in use.
- Identify where people tend to gather. Consider if people gather in a location because it is the only place where they can do a particular activity, or if the activity could be moved to a shaded area.
- Note whether people are using the shade already available.
- Consider if people are wearing sun-protective clothing or using portable shade.

Step 2: Determine the amount and useability of existing shade at the site

This step involves determining 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. It may be necessary to engage a professional or use a specialised computer program to project shade patterns throughout the year.

Ensure the site plan records the existing natural shade, such as the location of trees or groups of plants. Note details of each tree or planted area, such as maturity and the density of canopy, and whether the plant material is deciduous or evergreen.

Some points to consider at this stage:

- Where is shade available at the site – for example, from buildings, verandahs, shade structures, fences, adjoining walls or neighbouring properties?
- Can people easily access the existing shade? A garden bed or car park may occupy the best-shaded position.
- Ask users, managers and staff about the adequacy of shade at the site and the need for more shade.

Step 3: Consider the effects of reflected UV radiation

When identifying existing shade, you will also need to consider the potential for adjacent surfaces (walls, roofs or flooring) to reflect UV radiation into a shaded area.

Some points to consider at this stage:

- Note the ground surface of each outdoor zone – for example, concrete or grass.
- Note the surfaces of adjacent buildings and the direction they face.
- Consider if any of these surfaces can be modified to reduce reflection.

Step 4: Assess the need for improved or increased shade at the site

The next stage of the shade audit involves comparing the amount and useability of existing shade (Step 2) to the usage patterns (Step 1), while considering reflected UV radiation (Step 3). This will indicate if there is a need for additional shade.

Some points to consider at this stage:

- Consider the amount of existing shade at the Critical Protection Time and compare this with the need for shade.
- Consider whether the location of existing shade is appropriate, given the usage patterns at the site.
- Consider the likely impact of future tree growth on the amount of shade at the site. You may need to provide interim shade until trees have matured.
- Examine opportunities to better use or access existing shade.
- If additional shade is required, consider where it should be located, keeping in mind the site usage patterns and winter shade patterns.
- Consider reflected UV radiation at the site and ways to reduce its impact.

Step 5: Identify possible options to improve shade at the site

An increase in protective shade at sites can be achieved in several ways, including:

- Building permanent shade
- Using temporary shade
- Planting trees (natural shade)
- Increasing access to shade
- Moving or rescheduling activities.

Different settings will have different issues that need to be considered when making decisions about shade design.

Some points to consider at this stage:

- If you've decided to create new shaded areas, you need to consider the amount of additional shade needed, where it is needed and when it is needed (the times of day and year that the shade is required). Think also about the range of shade options (both natural and built) that may be appropriate, and their likely costs.
- Make the most of existing shade. For example, move activities or outdoor equipment to shaded areas, move seating to shaded areas, prune low branches on trees to allow access to the shade beneath them, or move garden beds that take up shaded areas.
- Investigate ways to improve access to shade. For example, open up shaded areas that are out of bounds, or reschedule outdoor activities to avoid peak UV times.
- Minimise the effects of reflected UV radiation by modifying surfaces or designing shade structures that protect from indirect UV radiation.
- Ensure that shade structures do not create safety hazards. For example, support systems such as upright posts should be clearly visible and ideally have rounded edges or padding. Shade structures should not obstruct views where adults are supervising children, particularly around playgrounds, childcare centres and swimming pools.

Planning, implementing and evaluating your shade project

Planning your shade project

Once you have completed the shade audit, you will have a comprehensive picture of the needs of the site. The next step is to plan, implement and evaluate your shade project.

Effective planning is essential to the success of any shade project. While the degree of planning depends on the size and setting of your shade project, the following points outline general issues you should consider including some of the steps outlined in preceding sections:

- Form a project team to develop the project. If possible, include people with skills in areas such as architecture, engineering, horticulture and landscape architecture, and people interested in the project or affected by it.
- Read and work through preceding sections of this resource to increase your understanding of sun and shade issues as well as the characteristics of your site. Prioritise your sites needing shade and consider the specific needs of each of the selected sites.
- Draw up a detailed site plan to identify features of the site. Identify the location of the shade project and of any underground services in the vicinity, the emergency 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.
- Estimate the costs of design and implementation. If applicable, explore sources of funding.
- Identify what permits, approvals and documentation will be required. It is important to consult the building and planning departments of your local council to ensure you comply with regulations and requirements. The regulations may vary depending on the council, the setting and type of construction. You may also need a permit to prune trees and other vegetation.
- Determine any external constraints such as heritage issues, environmental impact considerations and local community reaction.
- Develop a timetable for the shade project. Identify any time constraints, such as difficulty accessing a school site during a school term.

Preparing a design brief

You will need to draw up a detailed design brief to assist in applying for funding, tendering or constructing your shade project. The design brief should include:

- The overall site plan.
- Shade needs:
  - The Critical Protection Time
  - Where and when you would like the shade to fall
  - Preferred type of shade – for example, built or natural, permanent or demountable
  - The need for shelter from the wind or rain
  - The nature of activities – for example, children at play or vehicle movements
  - Climate of the area
  - Likely security or vandalism issues
  - Maintenance needs
  - Anticipated shade lifespan.
- Money and labour requirements:
  - Project budget
  - How the project will be overseen and monitored
  - Additional costs, such as insurance, liability and approval permits.
- Timeframe for completing the project.

Implementing your shade project

Selecting a company to implement a shade project

If you decide to engage a company to do all or part of your shade project, it is important to communicate your shade needs, project goals and budget, so that the company can deliver shade that is appropriate for your setting and requirements. The cost of engaging experts such as landscape architects and shade manufacturers needs to be included within your project budget.

When choosing the company to implement your project, consider the following questions:

- Does the company specialise in shade structures?
- 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.
- Can the company provide a list of previous projects and clients who can act as referees?
- Does the company's submission include certification by a structural engineer, the acquisition of permits and approvals, and outline relevant standards?
- What insurance (for example, public liability) is provided?
- Do you receive product warranties upon completion?
- What ongoing services (for example, safety checks, maintenance and cleaning) are offered, and what fees are involved?

Managing your shade project

Where more than one company or supplier has been contracted to provide services for a project, careful coordination and management are needed to ensure your project goals are met. 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.

Keep a written record of the progress of the project. This will help if the management of the project needs to be handed over to someone else, and is also useful for evaluating the project.

Evaluating your shade project

After your shade project is completed, it is a good idea to evaluate how well it meets the shade requirements of the site and its users. Evaluation will help in planning future shade projects, and can be done using the same approach used when you identified your shade needs. Useful questions to consider include:

- Was the shade installed according to the plan?
- Does the shade meet the design requirements?
- Do people use the shade?
- Were there any unexpected costs?

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