Shade Structures at the Prahran Pool

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SUMMARY

The shade structure at the Prahran Pool is one of the first of its kind in Victoria, and provides an attractive and practical solution to the serious community problem of over–exposure to the sun and ultra–violet rays. Covering the toddler's wading pool, and linking in with the architectural treatment of a refurbished entry and kiosk, this project comprises two separate membranes covering approximately 300 square metres, and formed of combined hyperbolic parabolas.

The Prahran City Council has taken a bold initiative in the provision of shade not only around, but over the toddler's pool, and complemented this with an education campaign of signs and leaflets to assist the residents of Prahran to lessen the risk of skin cancers for themselves and their children.

Unusual features of the structure include the use of common support poles with forces balanced between the two membranes, and "screw–in" steel ground anchors for tension and compression supports to masts and guys.

1. INTRODUCTION

Ozone depletion in the upper atmosphere is now a scientifically established phenomenon, and the effects it is having and will have on human beings have led to a major push from government bodies to provide shade in public spaces. Organisations such as the Anti Cancer Council of Victoria emphasise the importance of sun protection through campaigns such as their well–known "SunSmart" promotion. These campaigns target all age groups, with a particular emphasis on children, who are much more vulnerable than adults to the harmful ultraviolet rays which can easily damage their sensitive skin. In an effort to be "sun smart", and to assist their residents with sun safe enjoyment of the Essex Street pool complex, the Prahran City Council has undertaken a bold initiative in the provision of shade not only around, but also over the children's wading pool at the Prahran Swimming Pool. This complex is the premier outdoor heated swimming facility in Victoria, and the wading pool is an important asset which complements the main 50 metre pool.

In a forward–looking step, the City of Prahran has shown a responsible approach to the issues of sun protection by committing funds to this project. The Prahran Swimming Pool has the best attendances of any outdoor swimming pool in Victoria. An average of 800 people pass through its gate each day over the seven months of the year that the pool is open, with daily attendances peaking at 2700 people. One of the main attractions of the complex is a toddler's wading pool, which is very popular during the day with mothers and their infants. The Prahran Council felt that while there was quite a significant amount of shade provided on the lawn areas by trees there was no shade to the actual wading pool where the babies and children spent much of their time. Figure 1 on the following page shows the situation as it was prior to the shade structure being installed.

The solution sought by the City of Prahran was to provide the shade over the water, along with an education program for parents and children to reinforce the principles of sun safety. Tattersall Engineering Consultants Pty Ltd were asked by the council to design and manage the construction of a suitable structure that would create sufficient shade to protect the UV sensitive toddlers from the sun during the most dangerous times of the day, and yet be one that would complement the recreational feel of the pool side environment and the redevelopment of the entry and service areas.

Figure 1. The wading pool prior to the shade structure

2. DEVELOPMENT OF THE PROJECT

Tattersall Engineering Consultants Pty. Ltd. were initially engaged by the City of Prahran to prepare concept designs and budgets for a shade structure over the wading pool. Other works which were proceeding in parallel were the refurbishment of the entry and extensions to the kiosk areas at the pool (shown on the right of Figure 2.)

A number of concepts for the design were developed and reviewed with the client, and upon the acceptance by the City of Prahran of the preferred option, the consultants were appointed to design and manage the fabrication and construction of the shade structure.

3. SITE AND PROJECT PARAMETERS

The project brief was quite broad, being to create an exciting and attractive shade structure which would provide protection to children using the wading pool, and complement the parallel development of the entry and kiosk. The resulting structure is shown in Figure 2. on the following page.)

There were a number of constraints identified by the designers which impinged upon the size, setout, and details of the shade structures. These included

- the path of the sun and the patterns of shade which would be offered by the structure and surrounding trees to the pool, concourse and lawn areas,
- general public access around the pool,

- provision of sheltered out–door areas adjacent to the kiosk and entry,
- the appearance of the new structure from within the complex and from nearby Malvern Road, a major suburban thoroughfare,
- integration with the new kiosk building, the design of which was already underway at the time the decision to proceed with the shade structure was taken,
- numerous services (drainage, supply and return water to the pool, underground electrical cables, and irrigation pipework) around and under the concourse.

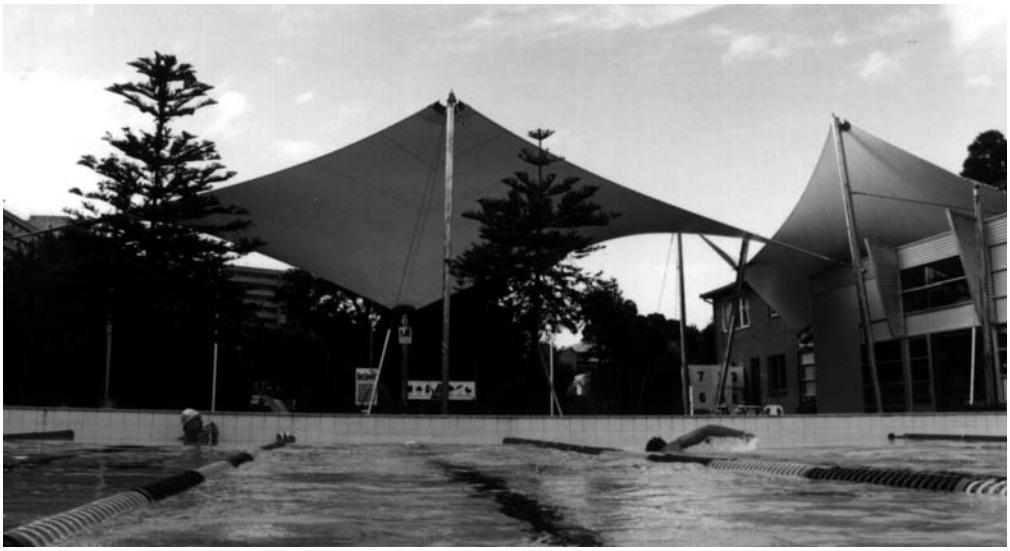

Figure 2. View of the shade structure from the middle of the main pool.

4. THE SOLUTION

The structure developed by the consultants has, according to the client, met their brief well and received widespread approval from the users of the pool complex.

The membranes are fabricated from a 900 gsm PVC–coated polyester fabric with an acrylic lacquer. Edge and guy cables are galvanised steel, and fittings and fabricated connectors are of hot–dipped galvanised steel. Masts and other steelwork are of hot–dipped galvanised steel.

In detail, the main membrane comprises two combined hyperbolic paraboloids basically in a rectangular layout, 20m by 12m, with the long axis in the east–west direction. High points at 8 metres were created in the middle of the southern side and at the northern corners. The low points in the middle of the northern side at the southern corners are at 4 metres. An additional mast and support point connecting to the separate membrane over the kiosk is incorporated in the middle of the eastern side of the main membrane.

The secondary membrane comprises three interconnected hypars, forming a membrane about 15 metres long and 5 metres wide, with the long axis in the north–south direction. Four support points on the western side are at steel masts, three of which also support the main membrane, and one of which has a single guy. The hypars to this membrane are canted at angles so that ”low” points vary between 3.4 metres and 5.0 metres, and ”high ” points vary between 4.3 metres and 8.0 metres.

Masts are steel circular hollow sections, with galvanised steel guy cables attached to screw–in anchors founded about 4.5 metres down in sandy clay. Compression support under the masts is also provided by screw–in anchors. An insitu concrete cap is provided at the top of the compression anchors, with holding down bolts to provide a partially fixed base connection. Rubber pads under the columns were designed to allow some movement yet still provide enough capacity for the masts to act as cantilevers in the event of loss of support from guys.

Although it is often wise in principle not to attach to existing buildings, the secondary membrane and some support cables were attached along the eastern side to a two–storey managers residence and to the steel frame of the new entry and kiosk. The fact that the two–storey building was of masonry construction with concrete floors meant that significant loads could be taken into the existing building, both directly and via the steel frame of the new extension. Some of these features can be seen in Figure 3. below.

Figure 3. View looking towards the kiosk and entry

5. ASPECTS OF THE CONSTRUCTION

As with many projects, ground conditions, services and access were some of the major difficulties encountered.

The access for large construction equipment was quite limited, both to get into the pool site, and because of limited manoeuvring area around the pool. Keeping damage to the existing paved concourse and lawns to a minimum was also an important consideration. Therefore the construction techniques and equipment were quite constrained.

The geotechnical investigation showed that the soil conditions were mainly medium dense sands and sandy clays, with a perched ground water table. Although bored piers constructed with reinforced concrete were initially considered for footings, the design soil parameters meant these were quite large, and hence were expensive. They also required large drilling equipment which would have been difficult to get into the site.

Use of the screw–in anchors meant that much smaller installation equipment could be used, site disruption was kept to a minimum, and resulted in much more economical foundation construction.

Another advantage was when unexpected services were encountered. Although the general location of services were known, the actual location was not able to be proved until construction started. Of course, some services were not at their expected locations, and services which had been installed many years ago to serve an additional pool, but not recorded, were also discovered. The screw–in anchors, which are removable, gave the flexibility needed to alter details of the design to cope with such occurrences.

Figure 4. shows the compression anchors, together with one being installed.

Figure 4. Compression anchors and installation equipment

6. UNUSUAL FEATURES OF THE STRUCTURE

Whilst hyperbolic paraboloids as a membrane shape are one of the most basic forms, this project does have some unusual features which are worthy of comment. These include

- the combined hypar shapes of the two membranes allows the final structure to respond to geometric constraints imposed by the existing pool and building, and the new building works,
- combined support points where loads from the two membranes are balanced through masts which are in turn supported by the membranes and edge cables,
- column base connections which allow for limited movement yet also provide increasing fixity under larger movements due to the designed compression of the rubber pads,
- the use of screw–in ground anchors for compression and tension anchors was an economical and effective solution to problems created by ground conditions and services.

7. CONCLUSIONS

The shade structure at the Prahran Pool has provided the city with a striking complement to their Essex Street Swimming Pool, and has been well received by patrons, management, and councillors.

The combined hyperbolic paraboloid membranes provide shade to the wading pool and surrounds, complement the architecture of the new kiosk and entry, and form a visually exciting feature which is light and airy, with minimum obstruction to the use of the pool, concourse and surrounding lawn areas. Figure 5 shows the finished project.

Figure 5. The finished shade structure, kiosk and entry.