

Bent Grass & Synthetic Bowling Green Surfaces: A Comparison of Surface Temperatures

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May, 2011

Abstract

The surface temperature of three bowling greens in Ballarat was measured to compare a natural turf (bentgrass) green with two types of synthetic green (synthetic grass and carpet). The ambient temperature in a standard Stevenson Screen was 37.8°C at the time of testing. The surface temperatures were measured with a Raytek Raynger Infra-red thermometer, with 15 measurements taken in randomly selected locations on each green. The mean surface temperature of the natural turf greens was 34.5°C, significantly lower than the synthetic grass mean of 66.4°C and the carpet green of 68.1°C (Least Significant Difference was 5.1°C). Such high surface temperatures on the artificial surfaces constitute a health risk that is currently not considered in the heat policy of the state bowls authority (RVBA Rules for Play, 2009. Rule 10: Inclement Weather).

Introduction

In 2003, Sport and Recreation Victoria provided funding to the Victorian Greenkeepers Association to investigate and report (in part) on the status of synthetic green installations in that State. Volume 1 of the Lawn Bowls Surfaces Study (2004) contained a comparison of natural turf and synthetic greens, and it contains responses received to a survey investigating the playing surface preferences of lawn bowlers in that State. According to the Lawn Bowls Surfaces Study (2004) synthetic surfaces were introduced as an alternative to turf bowling greens in the late 1970s–early 1980s. These surfaces were subsequently approved by the World Bowls in 2000.¹

In July 2003 there were 165 bowls greens with a synthetic surface, which accounted for 17% of the total number of greens in the state. At that time approximately 5% of clubs had a synthetic green as their only playing surface, whereas 72% of Victorian clubs at that time

¹ @leisure, *Lawn Bowls Surfaces Study*, vol.1. Melbourne: Victorian Greenkeepers Association, 2004:6.

had only natural turf greens as their playing surface. 23% had a combination of natural turf and synthetic playing surfaces.

According to the Lawn Bowls Surface Study (2004) many clubs at that time were moving to a synthetic surface as result of funding opportunities provided by councils and the state government: it is important to note that clubs have not generally been able to receive financial assistance where they wished to replace the surface with a turf green.²

In 2003, 25% of all greens in Group 1: Central Victoria were synthetic,³ – arguably because a majority of the area lies on the Great Dividing Range and up to that time it usually experienced large amounts of rainfall. However, between 2000 and 2010 the provincial city of Ballarat in Victoria recorded ten consecutive years of lower than average seasonal rainfall.

In many instances this ongoing change in climatic conditions across Victoria's Central Highlands region had dire consequences. For example, all of the water city's iconic Lake Wendouree evaporated: and a significant number of local bowling clubs and sporting organisations suffered a great deal as increasing harsh water restrictions took effect across the decade. Increasingly, towards the end of the first decade of the twenty-first century, Ballarat's bowling clubs were faced with the decision as to whether or not it was in the best interest of their club and its players to replace drought affected grass greens with more modern synthetic and carpet surfaces..

Trials undertaken by Neylan and Robinson (2004) demonstrated synthetic surfaces consistently offer greater green speed and 'draw' compared with natural surfaces. Their study also revealed there were economic reasons for installing a synthetic green: it is generally perceived that the cost of maintaining turf greens is higher, as is the potential for deriving increased income from an extended playing season.⁴

In Australia today 33% of all available lawn bowling surfaces are now synthetic. However, they are not without problems, and many bowls players continue to judge synthetic playing surfaces unfavourably. In particular, issues related to differences in surface temperature continue to trouble many players.

Anecdotally, and in trials conducted as part of other studies, synthetic surfaces have generally been deemed to be hotter to play on. In the 1970s, temperatures taken on a

² @leisure, *Lawn Bowls Surface Study*, vol. 1:7.

³ *Lawn Bowls Surface Study*, vol. 1:9

⁴ Neylan, J. and Robinson, M. 'Investigation of randomly orientated interlocking mesh elements/Sand root-zone system for bowling greens.' Available online via <http://archive.lib.msu.edu/tic/its/articles/1997pro87.pdf>

synthetic surface were shown to have risen to 60°C or higher on a clear day (air temperatures 24°C) whereas the maximum temperature of the natural turf was 32°C.⁵

Neylan's trial was conducted on a 39.7°C day, and results indicated one synthetic surface registered 62°C – while a couch grass surface registered 41.2°C. Alternatively, on a 30°C day – one synthetic surface registered 50°C while a bent grass surface registered 29°C.

In 1997 the environmental properties of three natural and synthetic greens in New Zealand were measured. Trials revealed that in cool to overcast, hot and clear conditions, synthetic greens were significantly hotter than natural greens – however, there was no significant difference in temperature at 1.5m above ground level. Importantly, Gibb's trials also revealed natural turf greens showed a buffering effect by cooling the surface by up to 5°C – this made it lower than the ambient temperature on days when the temperature registered 20-25°C thereby making the playing area much more comfortable for bowlers.⁶

Several of the people interviewed for the Lawn Bowls Surface Study (2004) also identified that playing conditions of synthetic surfaces vary more with the changes in the weather than turf greens. The study also noted a preference for natural playing on natural turf appears to increase with age

Each of these findings is relevant because Bowls Victoria introduced a 'heat policy' in relation to the playing of Pennant Competitions in 2009. The catalyst for change arose when young and old Pennant players alike were forced to play on as ambient temperatures soared into the low 40°C on several occasions in 2008 during Victoria's lengthy drought period. After it received numerous presentations from players and Clubs alike, the RVBA agreed to revise its Rules with regard to the conduct of competitions in an effort to assist Clubs who must demonstrate a duty of care under the Law.

According to Rule 10 in the RVBA Rules for Competition in Victoria (2009), Pennant play is to be abandoned for the day if the dry bulb temperature recorded at the Melbourne Bureau of Meteorology reaches 38°C at 11 am or 12:30 pm; if Pennant play has already commenced and the temperature reaches 38°C or above at 3 pm all play will be abandoned.⁷

⁵ *Lawn Bowls Surface Study*, vol. 1:13 cites Buskirk et al, 1971 and Mecklenburg et al, 1972.

⁶ R. Gibbs. 'Further comparisons of natural and synthetic bowling greens.' *N.Z. Turf Management Journal*, vol. 11, no. 3: 21-23.

⁷ *Rules for competition in Victoria*. RVBA, October 2009: 29. See Matches:E, Inclement Weather (i).

According to the results of each of the aforementioned trials strong evidence exists to support the anecdotal contention that synthetic surfaces have the potential to heat up to a level which might endanger a bowler's physical health and wellbeing.

In 2007, Luz Claudio reached a similar conclusion during a study undertaken by the Centre for Climate Systems Research at Columbia University. This trial was conducted in the early afternoon, in a New York Park, on 6 July 2007. Comparative results obtained during trial indicate:⁸

Atmospheric temperature	= 25.6°C
Surface Temperature:	
Grass	was 29.4°C
Surface Temperature:	
Synthetic	was 60°C

In 2002 another study was undertaken at Brigham Young University by C. Frank Williams and Gilbert E. Pulley. This trial was conducted slightly differently: they calculated the average surface temperature over a twelve hour period between 7 am and 7 pm. The results of this trial were calculated using air temperature recorded in the hottest part of the day.⁹

Maximum air temperature	= 36.7°C
Average surface temperatures:	
Synthetic turf	between 47.4°C and 69.4°C
Natural Turf	between 25.7°C and 31.4°C

In response to this study, I decided to conduct my own series of surface temperature trials. I wished to ascertain whether it would be possible to identify the existence of a similar disparity in temperatures on local bowling greens in Ballarat, especially on a day which was displaying similar weather conditions to those cited by Williams and Pulley. I opted to use a similar method on two synthetic surfaces in conjunction with a trial on a bent grass green – all in Ballarat.

⁸ L. Claudio. 'Synthetic Turf: Health Debate Takes Root.' Columbia University, 2007. Available online via <http://ehp03.niehs.nih.gov/article/info:doi%2F10.1289%2Fehp.116-a116> [accessed 20 June 2011]

⁹ C.Frank Williams and Gilbert E. Pulley. 2002. Synthetic Surface Heat Studies <http://aces.nmsu.edu/programs/turf/documents/brigham-young-study.pdf>

TRIAL TO COMPARE SURFACE TEMPERATURES BETWEEN A BENT GRASS BOWLING GREEN AND TWO TYPES OF SYNTHETIC BOWLING GREEN SURFACES ON A WARM SUMMER DAY

Aim

- To compare surface temperatures on grass and synthetic surfaces during hot weather;
- To discuss the impact of my findings on the current RVBA 'Heat Policy' for Pennant.

Research Locations

- Sebastopol Bowling Club;
- Central Wendouree Bowling Club;
- All located at Ballarat in Victoria, Australia.

METHOD & EQUIPMENT

Method

- Three tests were conducted at Sebastopol Bowling club and Central Wendouree Bowling Club on the 31st of December 2010 at 2.00 p.m.
- Fifteen surface temperature readings were taken on a Bent Grass green at Sebastopol Bowling Club, and I repeated this process on a synthetic green situated along side the Bent Green.
- I then travelled to Central Wendouree Bowling Club where I conducted a similar test in an identical manner on their carpet surface.

Equipment

- This trial was carried out using a 'Raytek Ranger' Infra-red thermometer. This device measures surface temperatures.
- Use of a 'Stevenson Screen' Temperature Box' (or similar) to record the air temperature.

CONDUCTING THE TRIAL

Sebastopol Bowling Club is located in Albert Street, Sebastopol. Both of the chosen greens (grass & synthetic) are located beside each other. They were selected in an effort to minimise variables which might bring about a misleading result.

Step One:

I recorded the air temperature taken from a standard temperature box (Stevenson Screen) which was 38.2°C.

Step Two:

I took fifteen recordings over the grass green. I later duplicated this method on the synthetic green.

Step Three:

In order to obtain a comparison between the synthetic and carpet surfaces I drove to **Central Wendouree BC** (Dowling Street, Wendouree) to repeat the test. The trip took approximately fourteen minutes by car (over a distance of approximately 5 kms) but as I was satisfied the temperature was sufficiently constant, I believed my trial results would remain unaffected by any time delay incurred.

Step Four:

I obtained a reading from their temperature box, however I must note that I was not convinced by looking at it that it conformed to the standard set by the Stevenson Screen' temperature box. An ambient temperature reading was recorded at 38.2 °C.

As my trial was conducted in a very simple but effective and accurate manner it was extremely difficult to manipulate my trial results.

TRIAL RESULTS

After completing my trials at two locations in Ballarat, on three different bowling green surfaces, on the one afternoon, these results were obtained:

Type of Bowling Green	Mean Surface Temp
Synthetic Surface	66.4°C
Grass Green	34.5°C
Carpet Green	68.1°C
LSD (P = 0.05)	5.1°C

Conclusions

From the readings recorded, and from the results of the corresponding tests as mentioned, I could confidently conclude that Synthetic surfaces are significantly warmer than Bent Grass surfaces.

Anecdotally there are many comments made by bowlers that Synthetic Surfaces are a lot hotter on “their feet” and it would seem the results verify those comments.

My findings offer further support to the trial results described earlier. They also offer further confirmation of the long held anecdotal belief voiced by players of lawn bowls on synthetic surfaces who argue they are hotter to stand and play on than turf greens. In my opinion, the much higher levels of heat generated whilst players are engaged in bowling on synthetic playing surfaces definitely has the potential to endanger the physical health and wellbeing of some players.

Accordingly, I believe it is important to ensure ‘Bowls Victoria’ is made aware of the contents of my Report. I would encourage the RVBA to urgently consider rewording the contents of the existing heat policy in order to make sure bowling clubs and their governing association are better able to meet their obligation to exercise the highest possible level of duty of care to all who play bowls on synthetic bowling greens in Victoria.

I will also argue any move to revise the existing 'heat policy' associated with Rule 10 (under the RVBA Rules for competition in Victoria (2009) offers an ideal opportunity to re-introduce an incentive to bowling clubs wishing to retain their existing grass bowling greens.

Keywords

Turf-grass ; turf-management ; variety-testing-and-evaluation ;

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