

Once the paint has dried, the tape may be pulled up, and the baselines and service lines painted on in the manner already described. The contractor should use line marking paint as recommended by the acrylic surface manufacturer. Some manufacturers supply a textured line paint to reduce the faster ball bounce off the lines.

Reference should also be made to sections 7.2.2.3 and 7.2.3.12 for more detailed information relating to line marking preparation and application.

**Limitations.** Acrylic materials should not be applied in high wind conditions. Surface temperature should be in the range of 12deg C to 40deg C. The material will dry too rapidly in surface temperatures above 40deg C, and will not cure properly in temperatures less than 12deg C.

**Hold Points.**

- (1) Inspection of the cleaned surface and agreement on depressions to be filled and cracks to be repaired. Client must be aware that structural cracking will almost assuredly return.
- (2) Inspection and acceptance of repaired surface prior to new surface coatings.
- (3) Inspection of finished surface. This should be done at about midday and at a distance of some three metres from the court surface. The surface should appear uniform in colour and texture, and free of noticeable blemishes. Allowance should be made for a slight 'windrow' effect. The alternating squeegee spreading of the materials will be apparent at different times of the day. This can be likened to the patterned mowing appearance on grass cricket and football fields, golf courses, and for that matter on grass tennis courts.
- (4) Final inspection after line marking.

### 7.3 Synthetic grass

#### 7.3.1 Definitions used in this section

Backing Material	Woven material, usually polypropylene, into which the fibres that make up the synthetic grass are woven.
Clean Sweep	Brand name of popular court grooming device consisting of a mat like structure that is dragged across the court. The device gathers leaves and other debris that can be disposed of away from the playing surface. The "Clean Sweep" also re-distributes the infill sand evenly across a synthetic grass surface.
Decitex	The Canadian and European equivalent to denier; equals the total weight in grams of 10,000 meters of fibre.
Denier	A unit of fineness for fibres, based on a standard mass per length of 1 gram per 9,000 meters of yarn.
Helicopter Trowel	Mechanical trowel used to achieve planarity in a concrete slab, so named because of the rotating blades.
Pile	The green (usually) fibre material that forms the playing surface in the outdoor carpet courts.
Pile Height	Length of pile. The standard pile height for synthetic grass courts is 19mm.
SFAG	Sand Filled Artificial Grass

#### 7.3.2 What is Sand Filled Artificial Grass (SFAG)?

Sand-filled artificial grass (SFAG) is, quite simply, a green coloured outdoor carpet that has been filled with sand, so that the tips of the fibres protrude giving the appearance of natural grass. However, this simple description defies the technology that has gone into the development of this product.

The carpet is manufactured in a similar manner to traditional carpet; however, the materials used in its manufacture are quite special. The carpet consists of a backing material with the 'pile' made of a propylene yarn inserted on a loom in a manner similar to a normal indoor carpet.

The basic materials making up the surface are illustrated in the Figure on this page. They are the **backing material**, the **pile** and the **sand** infill. The backing material and the pile are generally manufactured from propylene, which is an extremely durable product that, when treated, resists the destructive effects of the environment.



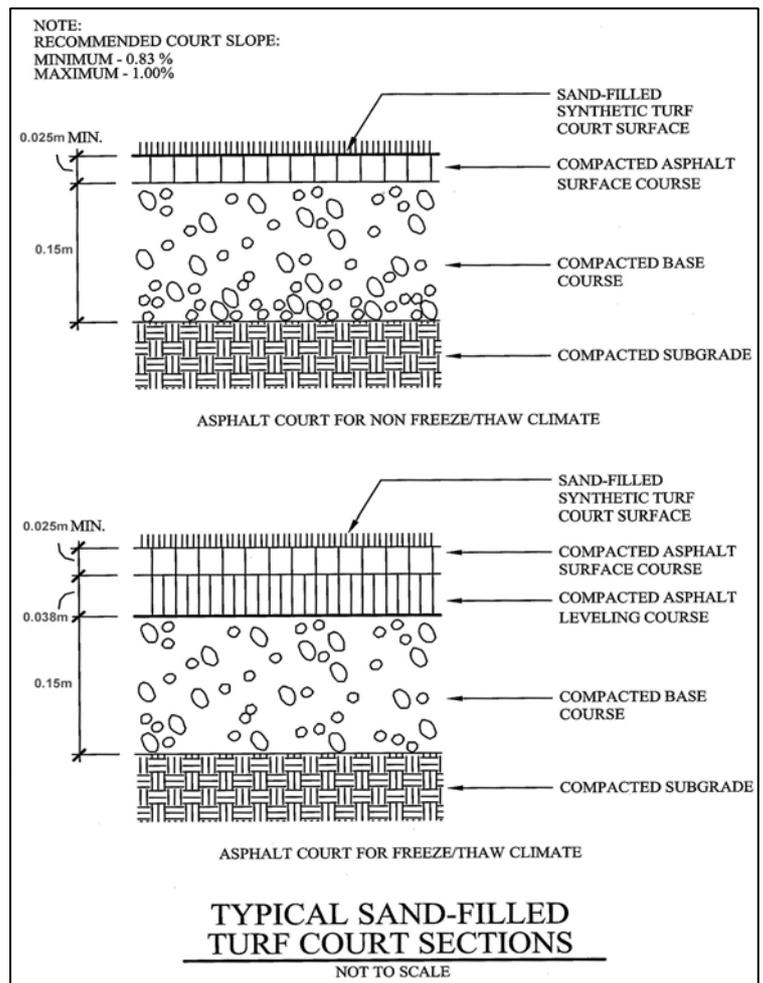
The combination of the yarn material used to produce the pile and mineral sand infill creates a sports surface with characteristics unlike most other tennis surfaces. Now twenty-five years from its introduction to the Australian market, it has found its place in many tennis clubs and on a majority of private courts around the country and is most popular for resort courts and with older players.

The range of different synthetic grass surfaces is extensive. There is wide variation in the design of synthetic grass surfaces as manufacturers continue to experiment with yarn variations and the ratio of yarn to sand. However, the product which seems to have evolved as a "standard" is a 19mm pile height, 10,000 denier carpet.

For the technically minded, this is 19mm pile height, 10,000 denier carpet with an average of 21 stitches to 100mm or 210 stitches to 1.00metre, a gauge of 10 mm and ideally filled with a majority of 750 micron "rounded" sand particles, preferably darker in colour.

The effect of the combination carpet and sand is to create a hardy earth-like sports surface underfoot with characteristics similar to but more easily maintained than other earthen mediums such as natural turf and natural clay-based surfaces. As with all tennis courts, poorly constructed base structures are often the real explanation for synthetic grass courts described as having "bad surfaces"

Properly installed over a well-constructed base, one of the greatest advantages of synthetic grass to tennis clubs and commercial centres is its drainage capacity and recovery to playing standard following rain. Less play time is lost to inclement weather with these surfaces, usually allowing play to continue immediately after rain which may make play unsafe on another surface.



### 7.3.3 Player preferences

The tennis players' preference for surfaces is too diverse to suggest any one surface as being "the best". Surfaces such as synthetic grass, ant-bed or hardcourt are favoured by different players. Within the range of synthetic grass surfaces available, debate also occurs over which particular specification is the best. Individual preferences exist for grip or slide, hard or soft, high sand levels or low sand levels, 'standard' pile height or short pile, etc. Adding to this debate, the ball can often react quite differently from court to court due to the various surface textures of the different synthetic grasses available.

The choice of court surface, or mix of surfaces, often presents a difficulty for the decision makers who are planning a refurbishment or establishment of a new club. Traditionally, where club membership is made up of older or Veteran players the preferred surface is synthetic grass, often in conjunction with a road-base court platform. These players generally agree that the greater impact absorption and slide capacity of synthetic grass is kinder to aging joints. Adding to this is the advantage of less rain interrupted playing time and the extra club income gained from social bookings.

Ultimately, the choice of surface is best made by the users of the facility. A poll of court users, usually the club members, will lead to a surface choice that will keep membership levels healthy. Membership is the most important factor in the long term viability of a club. A choice made on cost alone will not best serve the long-term interests of the club.

The tennis construction industry offers a range of base and surface options to satisfy court owners' preferences. Informed decisions result from thorough membership investigation that may include researching the experiences of other clubs, speaking with court builders and seeking advice from the State Tennis Association.

#### 7.3.3.1 Surfaces for social play.

Social players often prefer synthetic grass, based on the general ambiance, feel underfoot, comfort on the body, etc. The ability to recover following showers or storm is also attractive as it reduces the number of cancellations of the weekly bookings caused by rain.

#### 7.3.3.2 Surfaces for competition and tournament play

Synthetic grass is less preferred for competition play. At this point in time, Tennis Australia will not sanction any professional tournament or elite junior tournament on synthetic grass or synthetic clay surfaces. Hardcourts provide opportunities for a more tactical game where the court speed and foot grip encourage players to plan several strokes ahead of the winning shot. It is for this reason that Tennis Australia encourages the use of hardcourts for developing juniors as future champions. Conversely, synthetic grass properties encourage players to end a rally early.

Notwithstanding this, synthetic grass is very popular with clubs and is regularly used in club competitions around the country.

#### 7.3.3.3 Compromises for club committees.

The popularity of SFAG presents a difficult situation for tennis decision makers who are trying to encourage excellence in stroke making and court craft and require a surface that is consistent to teach these skills so as to keep pace with rapidly improving world talent. A large proportion of our emerging youth often gain their early experience from domestic and club synthetic grass courts but are quickly moved to hardcourts so that these skills can be honed. Further development of well advertised maintenance processes for SFAG courts is required so that these varying surface types can be complementary rather than adversarial.

### 7.3.4 Selecting a synthetic grass product.

The choice of which synthetic grass best suits an application is difficult. The synthetic grass manufacturing industry offers such a wide choice in materials, many of which look very similar and it becomes difficult for even experienced judges to make an informed decision.

Manufacturers are known to regularly alter the specification of their yarn and material suppliers creating inconsistencies with specification data for individual products from year to year. Tennis court building contractors who tend to be the intermediary of this information invariably claim valid reasons why the product they offer is superior to that of their competitors and thus it becomes very difficult for the buyer to make that properly informed decision.

Ideally, an objective durability test would predict the life span of a surface. Similarly, some form of “playability index” predicting the comfort for the players would assist. Unfortunately these objective measures are not available.

In the absence of a test for durability, the industry has chosen “face weight” as a measure of durability. Face weight is the weight of yarn that makes up the pile, measured from the top of the backing material to the tip of the pile. This measure works on the principle that the greater weight of yarn used, the better the product. This measure relies on the higher weight products lasting longer and assumes that each of the yarns being compared exhibit equal wear for a given mass. No objective measure exists for ‘playability’.

So, what is the correct choice? What makes one product superior to another? The answer is difficult given the small amount of data collected to date and the lack of records kept on individual court usage. Perhaps it is most appropriate for the buyer to deal only with manufacturers and contractors who have a proven track record and reputation as assurance of gaining the products and warranties necessary to long term satisfaction.

#### 7.3.4.1 Pile height

Synthetic grass is manufactured in a range of pile heights. Most common are 12mm, 16mm, 19mm, 22mm, 34mm. Others may be manufactured from time to time.

Just as in yarn denier (or Decitex) and stitch rate, pile height is also often varied to suit different sports, or to arrive at a product with alternate tennis playing attributes. One such product is now produced by most manufacturers and features a lower 16mm pile height often with a lower denier (Decitex) yarn but a much increased stitch rate. Properly installed, the result is a surface which is much greener in appearance since less sand is visible and which features a more certain foot grip more often associated with hardcourts. However, the all important sand content and its ratio to the yarn, along with refined installation techniques remain crucial to production of a successful tennis surface.

#### 7.3.4.2 Yarn varieties

“Yarn” describes the material that comprises the fibres that give synthetic grass its appearance.

Polypropylene is the yarn that has been most successful to date for Tennis with nylon enjoying pride of place for many years for the sports of Field Hockey and American Football, while the use of polyethylene is popular for Soccer. The introduction of polyethylene yarn into Tennis products highlights the ongoing development by the industry and manufacturers looking for an edge. This success of trials using different yarns has been mixed.

#### 7.3.4.3 Settling in time

The majority of SFAG sports surfaces will require a period of time to “settle in” before arriving at a point where they can be considered to be playing at their best. This time period can vary from 3 months to 18 months subject firstly to the method of and care in installation of both synthetic grass and sand infill and secondly to the amount of play it receives. Usually more use is best. The third and probably most important factor in achieving excellence in the playing surface is maintenance. A simple brooming and bagging regime can not only accelerate this “settled in” status but will create a consistency in playing characteristics that will satisfy the toughest critic.

#### 7.3.4.4 UV rating and deleterious effects of the environment

Although production of yarns without ultra violet inhibitors is a thing of the past, this remains an important factor in the long term performance of the completed carpet.

Glazing, or the action of surface fibres matting to form a hard and slippery crust, appears to be less of an issue than earlier years but is still seen on various courts. The industry remains undecided on blaming any one cause but rather a number of issues that come together in an apparent haphazard way to create the problem. The tips of the fibres split vertically as is considered normal but marry together then gather microscopic splinters of this fibre (often seen washed to the side of the court after heavy rain) together with other environmental fallout and set to form “glazing”

Glazing usually occurs in the heavy wear areas around the base-line first and is often seen at one end only of the court suggesting that loose particles figure heavily in the formation of the crust as it also seems to occur at the low end of the court first.

#### 7.3.4.5 Various manufacturers

A number of manufacturers of synthetic grass and SFAG now exist in Australia along with overseas suppliers assuring the sports surface consumer of a healthy competition with pricing always keen. Although the principle of mineral infill of synthetic grass arrived in Australia more than 25 years ago from overseas, much of its further development occurred in Australia and this development has gone back out to the world from here.

### 7.3.5 Mineral infill sand

The sand infill has a number of effects on what is generally an unremarkable carpet and its importance both in type and installation process often is, but should not be underrated. The task of the pile is to hold the sand in place while it in turn holds the pile upright allowing only the tips of the yarn to be exposed to foot traffic and the elements.

Synthetic grass manufacturers have been slow to agree on what is the ideal or most appropriate finished level of sand for their products and perhaps this is because it finally comes down to player or club preference. What is still required is sufficient knowledge and interest among the industry advisers to be able to assist the end user in arriving at final sand levels. While maintaining an excess of sand can protect the carpet from wear, it makes for less than ideal playing conditions both for ball bounce and footing and creates a greater need for sand levelling services.

#### 7.3.5.1 Grain size -minus one -750 micron

Finished sand levels will create varying play characteristics so that the choice of sand type and application method of the mineral infill is critical to the outcome.

While the size of the sand grains is important, the greater issue is that the majority of infill is the same grain size and that it be non-angular in shape. Sands available to the industry vary quite dramatically around the country both in size, shape and colour but most have settled on a range between 0.5mm to 0.8mm. The more rounded (non-angular) shape will assist in preventing premature compaction of the sand and helping with drainage. Some contend that grain size over 1mm is desirable because of its benefit to drainage. Because of the larger voids between the grains drainage flow rates must be improved but the heavier grain may cause extra abrasion to the yarn underfoot, thus hastening the wear process.

Whichever the choice a sieve analysis available from your local sand supplier will show that the majority of the supplied sand will be of a single size with smaller quantities ranging down to dust included but in far smaller proportions. These dust particles can be most injurious to the synthetic grass. Firstly they can be responsible for clogging up the



voids expected to be created with the chosen sand grain thus inhibiting drainage and secondly assisting undesirable compaction. It can also assist the “glazing” process as they are drawn to the surface during heavy rainfall. Playing characteristics of the surface can be affected, sometimes creating slippery playing conditions. It is hoped that few particles over the preferred size are included.

As part of the sand production the sand is sieved, washed and kiln dried. The washing process aids in removal of unwanted material and the dust particles. The kiln drying of the sand assists in neutralising any living organisms or vegetable matter captured in the mining process but its prime reason is to produce a dry material which allows its integration with the polypropylene yarn of the synthetic grass.

### 7.3.6 SFAG installation

The installation of SFAG commences with inspection and acceptance of a suitable base followed by a relatively simple carpet installation operation. This is complicated by a few features relating to knowledge of the product and line-marking for the game of tennis. Although the long pile and the mineral infill can disguise defects in both base and carpet installation techniques extreme care is still required with laying and joining processes.

Two items important to SFAG or in fact any installations for the game of tennis are:

- (1) Exactness of positioning and straightness of line and
- (2) Consistency of surface which allows confidence in ball bounce and footing.

If these elements are produced (and maintained) the players can be satisfied with SFAG as a playing surface.

Most manufacturers now produce their synthetic grass carpet with the majority of the tennis lines in-built and the following presumes this to be the case. Other sports very suited to the use of SFAG such as netball, basketball, volleyball and hockey may require much of the line-marking to be “cut in” manually but the processes will remain the same.

The width of the tennis playing area is 10.98metres (36 feet) and the carpet is 3.66 metres wide (12 feet) so that the set-out of the SFAG is almost always going to start with three 12'0"widths (36'0") through the centre of the court area with the tram-tracks and centre line woven into these three widths. These carpet lengths are carefully fitted to pre-marked chalk lines on the base and manually cut where overlapped to make good joins prior to gluing together.



These lengths are followed by the addition of the sections from tram-tracks to the fences on either side and then by the base-line sections at each end. In most cases these sections will include the actual base-line which may vary in width according to the rules of the game (1 inch, 2", 3" or 4") and the preference of the end user. It is important to note that these base-line lengths are laid “end-on-side” to the earlier sections of installation (contrary to good carpet laying techniques) and will present as a very different colour because of light reflected differently from each. Care must then be taken when applying the sand infill to correct this variation by “standing up” the pile on both base-line and general play areas. Done correctly this apparent colour difference will disappear.

Joining failures through use of inappropriate adhesives and/or application processes have been one of the most damaging and obvious features of installations performed over the last 25 years and through insufficient education and supervision of installers it will continue to be a problem. Such failures are usually exceptionally difficult and expensive to repair, often prompting the premature replacement of the carpet.

After achieving satisfaction with the trimmed joins and straightness of the line a joining tape is placed centrally under the juncture of each two widths. In the absence of manufacturer’s direction to the contrary these tapes should be a minimum of 400mm wide

at base-lines and joins where a line is being inserted (e.g. both service lines) and a minimum of 300mm wide at most other joins. Adhesive recommended by the SFAG manufacturer is then applied to the tape and the two sections are bonded.

The latex backing applied to most SFAG products is intended for pile retention and to give the carpet some body to assist its transport across the country to its final destination. Its bond to the polypropylene scrim (carpet backing) and yarn is not good, a chemical bond to polypropylene being difficult to achieve. Equally the bond of the recommended joining adhesive to the latex and poly-yarn is not strong and must be assisted by creating a mechanical bond which relies upon width and depth of adhesive to achieve its success.

Again, in the absence of specifications, the adhesive spread should extend to within 20mm of the edges of the joining tape taking care not to allow spillage onto the base. For most standard SFAG qualities a 3mm "V" notched trowel should be used so as to apply the correct quantity of adhesive to properly transfer to the heavily textured backing of the carpet. When joining carpets with less textured backing, finer notched trowels could be used. Care must also be taken to ensure that trowels or trowel blades are replaced as they wear down.

After allowing an appropriate time for the glue to "gas off" (the solvents will dissipate into the atmosphere) the two carpet sections are brought together and pressed onto the tape making sure that the gap between the first ribs of each section is no greater than the gauge of the carpet being installed (usually 10mm). Transference of the adhesive to the carpet is the first priority and this is usually achieved with a heavy roller. When sufficient time has elapsed for the adhesive to "tack off"



(usually about 20 minutes) this rolling process should be re-done to cement the bond. Subject to both the adhesive and the weather conditions no stress should be applied to this bond for a minimum of two hours. This process is repeated over the extent of the sport's area and left until adhesives are cured sufficiently to allow application of the sand infill.

Shrinkage and growth of the carpet through varying weather conditions will create difficulties and contradictions to the joining process. Experience will tell the installer how much strain to place on the width and length of the carpet while carrying out the laying process at different times of the day and at different times of the year. In the meantime, experience is a very difficult thing to teach, but it should be known that a polypropylene carpet that is joined together in the middle of the day in the middle of a Queensland summer that does not have looseness or a series of buckles in the areas between widths will almost certainly have problems with the joins separating either immediately or in later years. So long as these buckles are not too great, they can be worked back into the finished surface with the careful application of the sand.

Part of the continuing process of degeneration or aging of the carpet involves shrinkage which seems to be most prevalent during the onset of the winter months when breaks in various joins are reported and as mentioned earlier, this is a very labour intensive and costly exercise to repair. Such problems are less relevant, though still very real in areas where climates maintain lesser variations throughout the day and the year. The writer is not sure whether this is an issue that has ever or is currently being addressed by product manufacturers but confidence in the past performance of polypropylene as a medium for an economical sport's surface, both for wear and playability has now been proven. All of this information is offered to accentuate the importance of proper laying techniques in achieving a successful long term outcome.

After decisions are made about bases and synthetic grass qualities, and the synthetic grass is installed to satisfaction the sand application process becomes the most important section of the court project. As mentioned earlier this is an element that, because of its

heavy and seemingly thankless nature, is too frequently considered a task that must be endured and completed as quickly as possible. Yet it is this segment that will create the consistency to ball bounce and footing, therefore enjoyment of the surface throughout its life.

Because the manufacturing, packaging and transport processes can cause the carpet pile to be distorted care must be taken to correct the pile-lay during application. The installation itself of both the carpet and the sand also cause more distortion to the yarn and is often exacerbated by hot weather conditions. No one method has been refined to address this segment of the sport's surface installation, but all are agreed that to complete the sanding task with all pile over the court area standing erect is the ideal.

The following is a process that has achieved successful installations for over two decades.

The carpet should be totally dry before commencing the sanding operation and the kiln dried sand (around 15 tonne = square metre x 1 mm less than the pile height x 1.45) can be delivered, usually in bulk to the side of the court. Hand work will be required firstly to "work in" the buckles or looseness caused from "not" stretching the carpet during installation and secondly to correct the bent or twisted pile mentioned. This is also the time to marry the base-line sections and any other lines which are installed "end-on-side" to the general lay of the carpet. After satisfying yourself that these corrections are in order the sand should be applied over the total court area with the use of a fertiliser spreader with balloon tyres or wide flat wheels which will minimise further marking or squashing of the carpet pile.

Only sufficient sand should be applied that will line the base of the pile to a depth of approximately 3mm to 5mm. It will be seen that around half of this first sand layer will remain on top of the pile and can then be hand broomed against the lay of the pile so as to vibrate the sand into position while at the same time straightening the pile lay. This process should be repeated sufficient times until the pile is seen to be erect or before the sand can be applied more liberally.



This is also a reasonable time to introduce machine brooming. Whichever the machinery type used it should simulate the hand brooming described above but it is usual that this more robust mechanical method will compact the sand better than straight hand brooming usually making for a "settled in" playing surface more quickly. The final finish is usually produced with a "precision broom" done by hand to best estimate the amount of sand that will make up the final surface.

Whether paid or otherwise most contractors will return in a three to six month period to adjust the sand levels, either by adding sand or by taking it away, to suit client preference. The period can be subject to rainfall (more is better at this stage) since completion together with the amount of use the court has received. Done correctly and with regular maintenance no further sand will need to be added for the life of the court and in fact may have to be removed as the carpet pile reduces in height through normal wear and tear.

### 7.3.7 SFAG maintenance

Maintenance of sand levels is the single most important task in achieving consistent playing characteristics for your sand filled artificial grass (SFAG). While other issues are important to maintenance, the regularity of ball-bounce and footing are crucial to a successful sporting surface and whether the chosen surface has been designed for grip or for slide, it should be consistent. To this end the initial three to six month period of maintenance is the most crucial to long term happiness with the synthetic grass.

This is most readily achieved with the use of a broom with particular bristle stiffness similar to that probably used by your contractor during installation. A simple pushing of the broom up and down the court (best with the net put to one side) will achieve corrections with each pass as will occasional cross-wise brooming. If this is repeated regularly (weekly if getting plenty of use) until the adjustment service is due the contractor will probably have little to do but your court surface and the future enjoyment of it will be the beneficiary. A commercial centre may choose to mechanise this operation with drag brooms behind a rider mower or similar, but such a process should always simulate hand brooming and because of its abrasive nature and that it is more easily carried out, care should be exercised to ensure that it is not over done creating premature wear.

This weekly chore can be reduced to monthly (again subject to court use) after the "settling in" period and can be interspersed with the use of a Clean Sweep, a propriety product ostensibly designed as a leaf sweeper, which assists in maintaining even sand levels. In some States this action with the Clean Sweep is an accepted part of the protocol of the game, dragging/bagging the court after each match thus leaving a pristine surface for following players. This would be a worthy protocol to foster throughout all Clubs and private courts in all States.



Environmental issues play a large part in the required maintenance of SFAG, with fallout from trees, algae growing in areas often shaded by trees, overland flow from poor drainage and general fallout from adjoining industry or the atmosphere. These elements affect hardcourts, driveways, the roof of your house and in fact most areas of the home, but are often not noticed on the textured surface of a SFAG court until they (the algae for instance) are well entrenched.

Although the brooming described may create enough disturbance of the carpet pile to inhibit various algae growths, there will come a time when it is appropriate to call in professionals. A healthy maintenance industry exists within the tennis fraternity which can address all of the above provided that they always bear in mind the important issues that make SFAG successful.

Unless the carpet has been infiltrated by foreign matter it is rarely desirable to remove all of the sand from a SFAG surface as any areas so treated will need to go through the "settling in" period again. Most maintenance firms should be dealing with the top few millimetres of the surface and if removing sand with other polluted materials, care should be taken that the original sand levels are returned. They should also ensure that the treatments necessary on the side of a court do not assist in extending or spreading the problem across the full width of the court. Equally, cleaning of mechanical equipment after treatment at one address is important so that pollutants are not carried onto the next court to be serviced.

Treatment of infected areas by use of gurney or strong water jets should be carried out with caution so as to not remove an excess of sand which is difficult to replace consistently. Part of the apparent success of such an operation is emphasised by the as new "greenness" of the extra pile exposed below the top of the sand which can tend to mask any remaining algae growth. The use of blowers, although very efficient for leaf removal must be used with care as they too can remove some sand on each pass which in turn reduces the pile height and in turn the life of the carpet.

Chemical treatment of SFAG for algae growth has often been handled with the use of products such as copper sulphate or varying mixtures of pool chlorine and maintenance firms have their own proprietary anti-algae treatments. Such chemical treatments should only occur with the approval of the SFAG manufacturer who generally offers a seven year warranty on his product and great care should be exercised so that the general environment is not effected adversely.

Maintenance issues can be minimised by careful initial landscape planning through not planting inappropriate types of trees and not too close to the court (the root systems delight in ground conditions under SFAG) and the clearing of debris, leaf litter and any other infiltration. Good base construction through levels which shed water quickly, particularly in those areas shaded by trees or adjoining structures also assists in lowering of maintenance effort as will regular disturbance through sand levelling. A plastic lawn rake can make for hard work in clearing debris from the court but some solace may be taken in that the tips of the pile are being teased in a manner that assists the “settling in”.

The accepted norm for falls which allow good drainage of a court surface, whether SFAG or other non-porous synthetic surface types is 0.9% in both directions which on a minimum ITF court size of 34.77m x 17.10m will create falls of approximately 300mm in the length, 150mm in the width and 450mm from one corner to its diagonal opposite.

## 7.4 Synthetic Clay (outdoor carpet) surfaces

### 7.4.1 Introduction

Synthetic clay tennis court surfaces are a relatively new innovation into the tennis world, born from a number of circumstances; primarily the requirement for a waterless, low maintenance alternative to a natural clay surface.

Products currently available in the marketplace include POLICLAY, SUPERCLAY, and CLASSIC CLAY

Australia does not have a generic “clay court surface” like Europe and the Americas. EN TOUT CAS and RAW COURTS surfaces are the closest relatives, however they are constructed from a fired terracotta product and generally if kept in optimum condition are somewhat faster than the real clay surfaces. They also require a considerable amount of maintenance and consume significant quantities of water to keep them at optimum playing condition.

Ant bed, granitic sand and other localised “sand type” surfaces are also available using locally available raw materials. Generally these types of courts are installed at entry level with budget prices and are usually not suitable for serious competitive tennis.

Synthetic clay surface is designed to replicate the playing characteristics of real clay, being a slow to medium pace and forcing players to “construct points” using the full variety of stroke play.

A well constructed synthetic clay court will play and slide like real clay and replicate playing conditions both dry and wet, without the requirement for water and daily, monthly and annual maintenance.

White marking lines are “tufted in” to the surface providing permanent lines and eliminating the requirement for periodical line repair and replacement.

Weeds and grasses will not grow in a well constructed synthetic clay court.

Player comfort is much greater than most current high class surfaces, as the dynamic granitic type finish provides a built in softness underfoot (noting that some surfaces are softer than others and this should be researched by the potential client).

The softness allows extended periods of play minimizing potential impact damage and other related sports medicine issues.

Synthetic clay is environmentally friendly, replacing the need for considerable water usage.

No water is needed for play or maintenance on these surfaces.



## 7.4.2 Construction

Various methods of construction can be used for these courts, each with pro's and con's similar to those of sand filled artificial grass courts already discussed in this section.

### 7.4.2.1 Concrete Base

Site determined as suitable. Information provided in Section 6.6 above should be considered when constructing a concrete base for a synthetic clay surface. The subgrade should be expertly excavated with all unsuitable material removed.

Subgrade stabilized, compacted and graded to drainage falls of approximately 1% transversely and longitudinally draining to one corner of the court(s).

Use laser controlled grading equipment to ensure uniformity of subgrade and consequently uniform slab thickness.

Alternative levels may be used however remember the golden rule "less fall....longer draining...less play".

Concrete should be finished with a helicopter trowel.

Incorporated into the slab should be the footings for tennis net posts. These should be poured as part of the slab and be appropriately engineered as described in Section 10.

Also incorporate shallow dished spoon drains, expansion joints and kerbing etc as necessary.

### 7.4.2.2 Asphalt

Refer to Section 6.5 above for detail of asphalt base construction.

Court perimeter edging may be either bricks laid on concrete footing, concrete kerb or treated timber plinth. Various designs are available.

Install a compacted crushed rock base, using selected suitable fine crushed rock with a maximum particle size of 20mm with appropriate mix of fines.



Grade the rock using a motorized laser controlled grader to ensure uniformity and correct levels.

Water crushed rock during placement to ensure optimum moisture content.

Compact using a motorized twin drum roller with minimum static weight of 3 tonne.

Achieve a 95% compaction as per Australian Standards.

When rock placement is completed the finish should be dense and uniform, basically impervious with level tolerances no more than 5mm when measured with a 3 metre straightedge

Supply and install a hot mix machine laid asphalt layer, using a self propelled paving machine.

Asphalt shall be laid to provide a design layer of 30mm compacted thickness.

Asphalt shall be 7mm BCF grade.

Asphalt should cure for a minimum of 10 days before any surface is applied so as to void bituminous vapours and oils etc.

### 7.4.2.3 Drainage

Both concrete and asphalt provide a horizontal drainage system, whereby all water drains off the surface not through it.

#### 7.4.2.4 Crushed Rock

A crushed rock base is constructed as previously described however if no asphalt is to be applied, the surface must be finished with a 5mm crusher dust or manufactured granitic sand product to give a finer surface finish.

Needless to say that the levels are much more stringent than when installed as a base for a final asphalt layer, as this will be the finished base and any imperfections will show through to the completed surface.

The crushed rock alternative where used can be either impervious to water or fully or semi porous allowing vertical drainage. The design will depend upon local sources of raw materials and the design brief.

#### 7.4.2.5 Conversion System

A conversion system can be used when converting an existing En Tout Cas tennis court to a synthetic clay court.

- Remove tennis court lines and nails
- Rotary hoe the entire area to a depth of approximately 100mm
- Check subsurface drainage system is operative and in good condition. If not replace with a new system laid in a herringbone pattern and connected to mains.
- Laser grade surface introducing a crushed volcanic rock like scoria to augment court drainage if necessary.
- Compact surface with a twin drum roller whilst laser grading
- To the prepared base supply and install a manufactured granitic sand 5mm minus porous product as the final layer. Laser grade and compact. Hand finish as necessary.
- This provides a vertical drainage system for the new court.

#### 7.4.3 Synthetic Clay Surface

Installation and manufacture methodology is different for each product. However, these surfaces generally consist of a synthetic fibre carpet made from either polyethylene or polypropylene fibres, with differing pile weights and lengths

The white lines are made of the same fibres and are “tufted in” during manufacture of the carpet.

All joins are held using specialist adhesives and backing tapes.

Once the carpet has been laid by suitably qualified installers the “clay” surface is applied mechanically in various fine layers and groomed well into the fibres.

The finished level of the clay should be approximately 2mm above the carpet base.

Groom the surface to ensure correct coverage and uniformity.

#### 7.4.4 Maintenance

The court will require an initial “playing in period” of approximately 30 days during which time weather and playing will further settle the clay. Occasional odd bounces may be experienced during this time.

At the expiration of this period the court should be re-groomed with further clay applied as necessary.

Once fully groomed, the court can be handed over to the client.

Ongoing maintenance shall be light brushing of the lines using a rotary line sweeper.

Grooming of the surface with a drag mat to provide minor levelling and uniform surface material distribution is necessary. The frequency of this is by personal choice however indications from court owners suggest once prior to each match is sufficient.

The court may require up to 300 kg of coloured sand per year to replace that lost to erosion. This is a minor expense.

The industry is confident that the surfaces will provide up to 20 years of play before any major refurbishment would be required.

## 7.5 Natural Grass Tennis Courts

Grass tennis courts when constructed properly, provide the fastest surface on which tennis is played.

The surface provides for a “serve and volley” game where the ball bounce is low and fast and the speed can be adjusted by means of rolling, raising or lowering the height of cut or moisture control or a combination of all of the above.

The grass court however must be maintained on a daily basis to obtain the optimum performance whether it is for a Davis Cup Tie or a social hit.

This section outlines in a “layman’s language” the minimum standards to construct and maintain a grass court. It is to be used as a reference only.

A thorough and detailed planning of the project scope of works should be undertaken before construction begins to ensure all information is available and correct.

Areas covered below are:

- Construction
- Grass types
- Equipment
- General Maintenance
- Usage
- Preparation- Social/Competition
- Renovations
- Drop in Courts for Davis Cup Ties



### 7.5.1 Construction

Before construction commences it is important to choose the correct site and to have the necessary permits, and detailed information and plans in place.

A Northerly aspect for court orientation is advised to minimise sun in player’s eyes

Construction of the court involves:

- Excavation of site
- Forming a sub base with a slope of 1:100. Base must be a clay compound and glazed to assist with water flow
- Drainage- 100mm slotted agricultural pipe every 5 m in an e-w or diagonal design with a 1:100 fall and a main out let to a sump pit located off the court. Also have a drain at the northern end of the court to assist with water run off from the covers
- Main to be larger diameter if possible
- 7-10 mm pea gravel, in the bottom of the trench and 100mm deep over the level of the trench and laser levelled to 1% slope n-s
- Edging of concrete surrounds if applicable should have a final level 25mm below court surface finished level
- USGA spec sand 50mm deep
- 200mm of soil (clay loam 25% clay content) this should be checked by laboratory analysis before ordering. This is then layered in 50mm layers laser levelled and

rolled with a 1ton roller until 200 mm final layer is laser levelled and rolled to consolidate

- Laser levelling to be with a fall n-s with a +- 1.5mm variation an final grade of 1:100 is recommended
- Washed turf suitable for court usage laid and watered/fertilized regular until turf established
- Surveying of the site for lines/post layout/nets fences/lighting (use a good reputable survey company)
- Installation of net post sleeves/centre tie down
- Installation of fences/lighting
- Installation of irrigation/watering points

Sleeves for net post should be concreted in at a slight angle (.5 of a degree) outwards to allow for tension forces of the net and also be set below level of finished playing level so not to damage machinery.

Post sleeves should be embedded in concrete 1 m deep by 300mm wide.

Sleeves should also be capped when not in use

#### 7.5.2 Grass types

There is a variety of turf available today that would be suitable for tennis courts.

Some of these are:

- QLD blue couch
- Conquest
- Greenlees park in warmer climates
- Legend (although obtaining a pure strand of this variety is an issue at the time of writing)
- 328 variety

There are always new varieties being bred, so these choices will change over time once the newer varieties have proven themselves.

#### 7.5.3 Equipment

To obtain the best surface for the grass court the following equipment should be purchased:

Depending on the number of courts the following is the minimum for one court

- Cylinder type mower with 11 blades i.e. Toro 1600. John Deere 220, preferably with grooming reels for de-thatching
- Battery powered Line marker i.e. Supa turf
- Roller 1.5 tonnes max
- Squeezes/Supa -sopper
- Small fertiliser spreader
- Small sprayer
- Covers and sand bags
- Edger
- Level lawn
- Wheel barrow and shovels

- 19mm hose with fish mouth nozzle and soaker connection
- Scarifier
- Polishing dew roller with weights

#### 7.5.4 General Maintenance

Maintenance of the court is all year, with the start of the season and finishing with a renovation in spring / summer in preparation for continued use through the year.

Maintenance involves different routines depending on levels of play. For major tournament play such as Davis Cup or state and major championship play, this will involve intensive turf management.

For social play the level will not be as severe.

Maintenance required for both social and major tournaments involves the following:

- Mowing
- Rolling
- Fertilising
- Spraying chemicals for pests and diseases
- Repairing base lines, nets, line marking
- Light “dust ins” and general court maintenance

#### 7.5.5 Usage

Depending on the type of use the court should be rotated or rested on a regular basis.

If the use is for social play only the court should be rotated more and HOC should be raised to accommodate the level of play. It is important that committees understand that the turf will not hold up with constant usage and damage to the surface or excessive wear could result in a poor performing court when the time arises for it to be used for championship play.

It is also important that sufficient time be allocated for court(s) to recover from renovations.

For major tournaments, allocation of certain courts and a time regulation should be utilised.

The main court should NOT be used for practice until the finals with the exception of restricted time generally no more than 1 hour for teams to familiarise themselves with the characteristics of the court.

The practice courts and the main court should be maintained the same with no deviation in preparation.

#### 7.5.6 Preparation - social/competition

The Height of Cut (HOC) for social play can be as high as 8mm to allow for the surface to withstand high usage. If possible allow a day between cuttings and lightly roll to maintain good even bounce.

Vary the direction of the cut to prevent “grain” from becoming set.

For championship play the HOC is usually around 4-5mm or lower depending on the event, and the speed of the court. Mow in a N-S direction

The application of a nitrogen / iron fertiliser will provide more skid of the ball and a quicker surface a week out from the event.

Rolling and watering the courts can be used to find the balance leading up to the event to find the right amount of bounce for players.

Davis Cup Preparation is unique as the home team can dictate the type of surface it requires and this is reflected in the court preparation.

#### 7.5.7 Renovations

At the end of the playing season or around spring/summer the court(s) should be renovated.

This involves

- Taking a soil sample and testing for nutrient deficiencies
- Scarifying the surface to remove thatch build up.
- Coring the surface to allow air entry and allow granular fertiliser to enter the profile
- Topdressing using the same medium as constructed. This is very important.
- Laser Levelling if required
- Rubbing in the top dressing material with level lawns
- Fertilising based on a soil test result
- Applying chemicals to control pests/diseases
- Bring into play over 4-8 weeks depending on situation and usage requirements this involves lowering the HOC and light rolling, watering and finally reline marking

There is no substitute for a good renovation and taking short cuts is not advisable for long term playability of the court

#### 7.5.8 Drop in courts

In recent years the Strathayr Company in conjunction with Tennis Australia has developed a portable drop in court.

This involves the use of mesh elements and a drainage system combined to allow portability around the country for mainly Davis Cup ties if they are to be played on a natural turf court over artificial court.

- The squares are 2.4m x 2.4m (6m<sup>2</sup>) 200mm deep and weigh 1.7 tonnes.
- The soil is 150mm deep and is reinforced with mesh reflex elements squares fit together by forking into place.
- A court consists of 160 modules and each module is numbered for a perfect fit.

This system allows the surface to be placed into position within 12 weeks.

#### 7.5.9 Irrigation

Installation of an irrigation system will provide correct amounts of water to the court

The Toro 2001 series sprinklers are ideal for single courts.

To install a Toro 2001 series on a single court will require 2 X half circle sprinklers and 4 X quarter circle sprinklers

For double courts the system can be configured to run independently for a two-court application. This will involve upgrading or installing a controller with sufficient stations to cover two courts.

A main controller with at least 4 stations will also be required.

As with all irrigation systems connected to the mains water supply, there needs to be a back flow prevention device. Generally a dual check valve is sufficient, but check with the local Council for their requirements.

Companies with trained staff with irrigation installers licences are available in Qld to install such systems. One company is TIS (Turf Irrigation Systems) at Capalaba in Brisbane's eastern suburbs.

Generally to install a system on a single court will cost around \$4,500.00 (as at the time of writing).

If a club wishes to do the installation itself, be sure that the person installing the system has the restricted plumber's (irrigation installer's licence).

#### 7.5.10 Grass court maintenance

Grass courts require maintenance throughout the year.

This will ensure

- A firm surface that provides good traction for players
- An even bounce of good height
- Even density and colour
- Good presentation of the court being weed, disease and pest free.

After renovation the following maintenance is generally undertaken, and can be broken down into seasonal requirements.

N.B: Please note that the seasonal months submitted here are related to central Brisbane and are related to on site weather station readings collected over a period of time. It is important to remember that these can and could change. It is advisable to check local conditions and make necessary changes to individual clubs programs

SUMMER Season in QLD: December – Early March

Mowing: In general remove only a third of the leaf and mow only when surface is dry.

The court should be mowed at least every second day, which will provide a tight surface. In some places mowing daily will need to be carried out.

Hoc will be around the 4 to 8mm area depending on use and competition.

It might be required that the court be double cut on occasions, depending on growth.

Be sure that the blades are regularly sharpened by back lapping the cylinder with grinding paste.

Irrigation should be applied deep and infrequent and ideally should be applied based on ET rates for the area. Root depth also needs to be taken into account when doing this.

##### 7.5.10.1 Spraying

A person with an appropriate chemical licence, such as "Chemcert" or "ACDC" should undertake the application of any hazardous chemicals. The individual club should also have a chemical distribution licence. The chemicals should also be applied as per manufacturer's recommendations.

Applications of fungicide for diseases relating to summer months will need to be applied. These diseases can be either root or leaf and appropriate fungicides will control or eradicate any outbreaks.

Spraying for pests such as armyworm, couch mites, couch fly, and black beetle can be controlled with appropriate pesticide chemicals.

Applications of herbicides can be undertaken throughout the season, but best applied before renovation to allow the turf to recover.

##### 7.5.10.2 Wetting Agents

Wetting agents are applied when the profile needs an even wetting up or where there is lack of sufficient rainfall to evenly wet the profile.

#### 7.5.10.3 Fertilising:

Before starting a fertiliser program it is important to obtain a soil and if possible leaf analysis of the court to determine the exact nutrient requirements and deficiencies and correct these before going into a maintenance program.

Soil tests should be conducted at least twice per year to gauge soil and plant requirements.

In general after renovations, a fertiliser higher in phosphorus should be utilised to establish the root system and also enable the addition of organic fertiliser into the profile.

Regular fertilising with a mixture of Nitrogen and Potassium ratio of 2:1 will ensure good recovery from wear and produce lateral growth, as well as maintain the colour and speed of the surface.

It is also important to add trace elements as required, but soil tests will indicate any deficiencies.

Turf specialist companies such as but not limited to- Globe, Nuturf, Simplot, T&I and Floratine have a range of fertilisers to suit requirements for closely cut turf.

The fertiliser can be applied in granular or in liquid form.

In all cases of fertiliser application, the directions of application on the label should be adhered to.

The ratio will then drop from 2:1 to 1:1 from late February to prepare for colder months.

With the profile being mainly clay it is important to consider the application of liquids and foliar fertilisers to assist with maintaining a dryer profile leading up to games.

All companies have a folia range and these should be examined to ensure that the correct product is applied.

#### Winter Season in QLD –March to September

Fertilise with a ratio of N: K 1: 1. And in colder areas a ratio of 1:2 could be considered.

This will enable continued recovery of the baseline and provide sufficient nitrogen to maintain growth.

Be careful to watch the nitrogen component of the product to ensure that it is not too high.

Adding sulphate of iron (chelate type) and magnesium sulphate will assist with colour.

#### 7.5.10.4 Mowing:

Mowing to be carried out to remove one-third the leaf tip generally, but again local conditions can change this to everyday if temperatures increase top growth. Mowing twice per week should be considered where temperatures are in the colder regions.

Raising the HOC a millimetre or two will provide better protection to the surface from excessive wear

Irrigation again depends on ET rates but generally less than for summer months

#### 7.5.10.5 Dethatching and aeration

During the summer months a regular dethatching program should be undertaken to limit the amount of thatch build up and lateral growth, which left unchecked, will result in a slow court and “spongy” surface.

The operator will need to judge when the use of this machine is needed.

The use of a pedestrian scarifier or use of the dethatching vertical blades on the reel mower will remove sufficient thatch. It is important not to allow the blades to bring up soil as this will result in the surface taking too long to recover and will leave unsightly lines. Generally set blades 1mm below HOC.

Aeration usually involves the use of a “vertidrain” with 8mm tynes. Again the manger will need to access the frequency and tyne selection relevant to court usage and what he/she wishes to achieve by using this practice.

#### 7.5.10.6 Topdressing / "dust ins"

Application at renovation of the same medium as the profile to top dress the court will be required. The medium should be dry if possible to allow ease of application. Once applied the surface is rubbed in with level lawns to ensure good surface contact.

Periodically the court can be “dusted” using a sieved material to lightly cover the court to assist with wear recovery particularly on the base line and centre areas.

#### 7.5.10.7 Rolling

Rolling of the court should be undertaken to firm the surface not to make the surface “rock hard”.

In the summer months when the surface has a lot of “grass” the rolling can be done frequently. It is important to finish by cross rolling to eliminate lines from the roller.

Rolling with the playing court first then finishing by rolling across court will ensure that there is no deviations in the surface that will affect the balls bounce.

Double rolling, that is coming back on a slight angle along the first line of the roll, will also help with this.

Always take into consideration the condition of the soil. If the profile is too wet, rolling may cause ridging and if too dry it will be a waste of time.

Roll outside the playing area first if ridging is a concern and inspect before proceeding.

The amount of rolling will determine how high the ball bounces and generally for social competition a bounce from knee to waist height is ok.

Roller weights should be 1 tonne and 2 tonne rollers

#### 7.5.10.8 Spring (Renovation Season) - October to December

Renovation should be carried out at the end of the season and will involve the following practices:

- Scarifying of surface and clean up
- Aeration (coring)
- Fertilising with amendments
- Topdressing
- Watering
- Bringing into play by light rolling and reducing HOC to a playing HOC

Refer to previous section

## 7.6 Compacted earth bases

### 7.6.1 European Clay

#### 7.6.2 Introduction

There has been a lot of discussion in recent times about the need for juniors to be trained on European type clay courts. Most top coaches agree that training on clay courts provides benefit for aspiring young players. The need to ‘work’ for a point builds strength and endurance, whilst cultivating a strong technique.

The downside for clubs and users is that a clay court requires more maintenance than hard courts and synthetic grass courts. Do the advantages of clay courts outweigh the maintenance problems?