In May, Melbourne soccer, rugby union and rugby league fans witnessed the opening of the city’s first purpose-built rectangular pitch stadium. Some three years in the making, AAMI Park boasts a capacity of 31,000 and will be home ground to four of the city’s premier sporting teams. Arup senior civil engineer Jarrod Hill and Melbourne Olympic Parks Trust horticulture manager Adrian Black look at the construction of the $267.5 million facility, its playing surface and maintenance requirements.

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orted within Melbourne’s sports and entertainment precinct, the state-of-the-art AAMI Park is the first purpose-built rectangular pitch stadium in the city. The 31,000-seat stadium boasts an eye-catching lightweight bio-frame roof comprised of 20 interdependent domes which provide 80 per cent coverage for spectators against rain, unobstructed views of the ground and integration with a drainage system designed to collect rainwater for reuse.

Officially opened on 7 May 2010 when the Kangaroos defeated the Kiwis 12-8 in the 2010 ANZAC rugby league test, AAMI Park is the new home to the Melbourne Storm NRL side, Melbourne Victory and Melbourne Heart football (soccer) clubs and the Melbourne Rebels which enter an expanded Super 15 rugby union competition in 2011.

Melbourne-based civil engineering company Arup collaborated closely with Cox Architects and Grocon on the stadium design, providing structural and civil engineering, facade engineering, pedestrian modelling and arena consultancy. Arup worked closely with client Melbourne Olympic Parks Trust (MOPT) and subconsultants Irrigation Design Consultants and AGCSATech during the design and construction process to ensure all requirements were achieved and a world class facility and playing surface was delivered.

THE BRIEF

The brief for the playing surface appeared simple – design a FIFA and International Rugby Board approved flat playing surface that can be used to host football (soccer), rugby league and rugby union. The challenge for the designers was the frequency of use for sport and entertainment exceeding 50 events per year. This meant that the playing surface had to endure high wear throughout the year with minimal recovery between matches.

Arup identified early in the project that the following key design elements had to be addressed to ensure the pitch could withstand the high intensity of use:

- Sunlight – a minimum of four hours of direct sunlight on every section of the playing surface;
- Ventilation – adequate air flow across the playing surface to assist with breaking the mildew process; and
- Routine maintenance/turf replacement – the proposed profile should be designed so that the playing surface can be readily maintained and allow for a successful turf replacement regime.

There was also an overall requirement to incorporate sustainable design into the stadium. This translated into the following design elements for the playing surface:

- Minimise water requirements for the turf – profile composition to create a perched water table;
- Efficient irrigation design – irrigation layout to maximise coverage and minimise overwatering, including no overspray into the seated areas.

THE PROFILE

The natural turf playing surface is 130m x 76m with a 3m wide perimeter synthetic grass surround. The flat playing surface is based on USGA putting green construction, with a 300mm rootzone sand layer overlying a variable depth drainage gravel blanket. The top 100mm of the rootzone sand layer is amended with peat moss.
The USGA putting green construction methodology relies on the creation of a perched water table at the interface between the rootzone sand layer and the drainage gravel blanket. Once this layer is saturated, any additional water passes through to the gravel drainage blanket below. The system allows for a very well drained surface, while providing a moist environment below the surface which promotes turf growth and health.

The AAMI Park profile is reinforced with StaLok fibres. The fibres were incorporated into the 60mm instant play turf profile to ensure a stable surface despite some sections of turf being laid only two weeks before the opening night. The turf consists of Legend couch which underpins a mix of SR 4600, SR 4220 and All Star 2 fine leaf ryegrasses. The Legend couch was selected because of its low thatch accumulation, high vigour and rapid recovery after wear. It is also conducive to oversowing and supports the ryegrass well.

The selection of ryegrasses were chosen after two years of trial work and feature excellent wear tolerance and recovery from injury, improved summer stress tolerance and active winter growth. A major feature of the new improved varieties is the vivid dark green colour. The perimeter synthetic grass surround sloped away from the playing surface with any runoff collected by a perimeter trench grate system that connected to the trunk drainage network.

DRAINAGE AND IRRIGATION
Due to the flat playing surface, drainage occurs via infiltration through the profile and is collected in the underlying subsurface agricultural drainage network.

Working with AGCSATech, Arup produced a detailed profile construction specification for Grocon.

To enable collection of the infiltrated water through the profile, a ridgeline was formed in the subgrade in the middle of the playing surface along the length of the ground. Infiltrated water runs along the sloped subgrade layer until collected by subsurface agricultural drains spaced at regular intervals. The subsurface agricultural drains are connected to larger collector drains that fall to the perimeter trunk drainage network. The subsurface agricultural drains are configured in a traditional herringbone pattern.

The turf irrigation system for the stadium was designed by Irrigation Design Consultants to achieve five essential criteria:
- Application of 12mm irrigation depth in eight hours of operation;
- Individual time control over every sprinkler;
- Flexible irrigation scheduling to accommodate all pitch uses;
- Remote rootzone moisture monitoring; and
- Highest application uniformity possible.

The rectilinear layout of the playing surface, with seating on all sides, constrained sprinkler set-out geometry to few options. The final design comprises 49 pop-up rotary turf sprinklers covering the full pitch, with an extra five being utilised when moveable seating/stage intrudes onto the turf surface at one end. The final layout is a near-perfect, equilateral triangular geometry, based on 19 metres between sprinklers. All pipework on the pitch is medium density polyethylene with a pressure rating of 12.5MP.

The proposed sprinklers were independently tested to confirm compliance with the high uniformity criteria. The following, theoretical, statistical uniformity criteria confirm the high uniformity achieved:
- Precipitation rate (at 485 kPa): 12.4 mm/hr;
- Christiansen uniformity coefficient (CU): 90 per cent (ideal 100%, min 85%);

Despite dreadful weather, Melbourne Olympic Parks Trust horticulture manager Adrian Black and his team had AAMI Park in superb condition for its official opening in May.

In a first for Melbourne, the new AAMI Park rectangular stadium will be home to the Melbourne Storm NRL side, Melbourne Victory and Melbourne Heart A-League soccer clubs and Melbourne Rebels Super 15 franchise.

Picture © John Gollings
Distribution uniformity (DU): 87 per cent (ideal 100%, min 75%); and

Scheduling coefficient (SC): 1.1 (ideal 1.0, max 1.4).

To provide individual timing for every sprinkler, a solenoid valve is installed under each and the system is operated by a computer control system which can apply multiple irrigation schedules, created to suit any pitch use scenario. To assist with scheduling and to economise on water consumption, remote output soil moisture sensors have been installed in the rootzone at several locations.

SUN/SHADE STUDY

In light of recent shade issues at other stadia around the world and the effects this has on turf health, Arup provided MOPT with stereographic images that illustrated the annual daily sunlight across the playing surface during the year (a 10m x 10m grid was created across the whole surface).

These images were reviewed by Dr Andy Newell, head of turfgrass biology at the Sports Turf Research Institute (STRI) in the United Kingdom. Andy identified that in winter, the northern end of the ground may require supplementary light due to prolonged periods of insufficient direct sunlight. As a result, MOPT is considering purchasing two artificial light rigs.

VENTILATION

Scaled model wind tunnel testing, used to verify structural wind loads, was also used to establish the wind/ventilation profile at the playing surface. The specialist consultant advised that the shape of the roof and orientation of the stadium assisted ventilation and that adequate cross-flow air movements would exist to keep the turf in good health.

CONSTRUCTION AMENDMENTS

Given the constrained nature of the site, Grocon identified the arena as a temporary construction platform and lay down area for the roof and internal stadium construction works. This meant that the programming for the arena works were governed by these construction processes.

Should construction of the stadium be affected and subsequently the programming extended, this would greatly affect construction of the playing surface and potentially risk the establishment of the turf. To address this risk, MOPT, in consultation with the design team and Grocon, decided to order pre-established 60mm reinforced turf sod rolls rather than the initially specified washed turf.

The initial design for the arena included a 3m wide light duty perimeter pavement covered by synthetic grass for the use of maintenance vehicles and to assist with roof shading. During construction the pavement thickness was increased so that it could act as a construction access road and staging area for Grocon. Grocon also requested that four tower cranes be located within the corners of the arena for the duration of major construction work elements. Changes to the drainage configuration were made to accommodate these.

CONSTRUCTION PROCESS

Stadium construction began in October 2007. Among all the piles, slabs and footings for the stadium, the construction of the perimeter retaining wall was the first sign of the shaping of the arena. As sections of the arena became available, the subgrade shape was formed.

The formation of the ridgeline in the subgrade and construction of the retaining wall resulted in stormwater being directed to the interface of the subgrade and retaining wall. Due to construction programming, the proposed drainage network had not been installed and temporary drainage measures could not cope with large storm events.

This resulted in prolonged ponding of water at this interface and the subsequent saturation of the subgrade in these areas. Ground improvement works were required to dry the saturated subgrade material and additional drainage was installed along the perimeter.
A temporary arena access point was constructed off Olympic Boulevard in the north-west corner of the arena and all materials for the arena and roof were delivered here. To begin with, delivery and stockpiling of the rootzone sand and drainage gravel material was relatively easy. However, as construction works got closer to the northern end, space became an issue as stadium construction plant and arena works began jostling for position.

Working in line with the construction programme, the southern end of the arena was constructed first. The arena was constructed up to the halfway line of the pitch and from there the north-east quadrant was constructed. This was followed by the north-west quadrant, which included completing the perimeter retaining wall and subsequently closing the arena access road.

The following construction methodology was generally adhered to for each section of the arena as it became available for construction:

- Trenching, laying and backfilling of irrigation main;
- Trimming of subgrade;
- Trenching, laying and backfilling of collector mains (providing off-takes for subsurface agricultural drains);
- Construction of adjacent perimeter concrete slab (including trench grate);
- Trenching, laying and backfilling of subsurface agricultural drains;
- Installation of goal footings;
- Re-trimming of subgrade;
- Placement of drainage gravel blanket layer;
- Installation of irrigation sprinklers;
- Placement of 200mm layer of rootzone sand;
- Handover;
- Placement of 40mm amended rootzone sand; and
- Laying of 60mm pre-established sod rolls.

At the completion of every placed layer, a 5m x 5m level survey was completed to confirm construction tolerances. No subsequent layer could be placed until the previously placed layer had been signed-off. Infiltration rates were also taken for the completed drainage gravel blanket layer and subsequent rootzone sand layers.

**CONSTRUCTION ISSUES**

One of the main areas of concern during construction was contamination of the already placed profile layers and installed services due to construction traffic and delivery of profile materials. Due to tight site constraints, the delivery trucks had to stockpile the new material on already placed layers. At times this resulted in excessive rutting of the placed layers which were subsequently removed and replaced.

The drainage lines and irrigation mains were often laid well in advance of the placement of the drainage gravel layer which rendered them susceptible to damage from heavy vehicle traffic.
The natural turf playing surface is 130m x 76m with a 3m wide perimeter synthetic grass surround. The flat playing surface mixture of SR 4600, SR 4220 and Legend couch which underpins a AUSTRALIAN RENAS

The Legend couch was selected for the opening night. Heavy duty road plates were used to protect these services from construction traffic. Where there was concern that a backfilled service may have been damaged, the service was exposed and inspected.

The decision to have a turf contractor (Evergreen Turf) place the pre-established reinforced sod rolls and remaining amended rootzone sand meant that Grocon and their subcontractors would be required to complete the construction of the profile prior to handing over to the turf contractor. The two parties agreed that this handover process would be undertaken in stages.

OPENING NIGHT
A near capacity crowd of 29,442 attended the opening event at the new stadium with Australia winning the one-off ANZAC Test 12-8. Preparation for the opening night was a challenge due to the fact the field turf was installed in sections from January through to March. The internal sections of turf were completed by March, however, a three-metre perimeter section of turf was not installed until three weeks before the opening night.

MOPT and Evergreen Turf coordinated matching cutting heights and maintenance regimes to ensure the remaining turf, when installed, would look and play the same as the existing turf in the stadium. To add to the difficulties, Grocon needed to run large boom lifts along the east and west sides on the newly laid turf to facilitate the final alignment of the internal field lights and stadium speaker system.

On completion of these works the MOPT horticulture team had a full week to prepare the field. The playing surface performed exceptionally well and players from both sides were able to maintain their footing despite the wet conditions. Endorsement from the Australian and New Zealand players following the match was very satisfying and vindicated the meticulous preparation and planning that went into the opening night.

MOPT’s horticulture team collectively possesses a wealth of experience covering all of the skill sets required to manage the diverse forty-hectare precinct. Adrian Black, as horticulture manager, has over 25-years’ turf industry experience including 12 years as head curator at Victoria Park, three years as contract manager with Spotless Services and three years as sportsfield specialist with Rain Bird Australia. Adrian has been team manager at MOPT for the past 7.5 years.

He is strongly supported by sportsfield coordinator Justin Lang who recently joined MOPT from Etihad Stadium where he was assistant to Gavin Darby. The remainder of the team is comprised of Brendan Wiegard, David Graham, Cyrus Tabualevu, Phil Thornton, Kevin Haddow, Trent Lamb and apprentice Brad Lowe. Each member of the team brings unique and invaluable experience and worked tirelessly to make certain the opening night was a success.

A feature of the Rocla medium washed sand profile is a very high drainage rate, however, with this comes the leaching of valuable nutrients. MOPT has incorporated bi-monthly soil reports and quarterly root health assessments to enable accurate tracking of the turf profile and monitoring of nematode numbers. Occasional leaf tissue analysis is also carried out to check nutrient levels.

These reports form the basis of MOPT’s maintenance programme, which includes the frequent light applications of granular and liquid fertilisers. Due to the fact the pH of the sand was initially low, regular applications of lime are required to raise the pH to neutral. Reports indicated CEC levels were also low, therefore the regular use of organic products is required to increase activity.

MOPT has developed a preventative disease programme that involves the use of contact and systemic fungicides. Regular aeration and topdressing of the field is carried out to maintain high drainage rates and to reduce thatch accumulation. Constant re-seeding is required to maintain healthy ryegrass plant numbers and to prevent the outfield from thinning out during times of high wear. Following every match the field is monitored for divots, and these are topped up with sand and seed. Insect pests are tracked and preventative applications of pesticides are used sparingly.

As previously mentioned, shade has been identified as a potential issue at the northern end of the field, therefore MOPT has been proactive in purchasing growth covers and is looking to purchase two large lighting rigs in the new financial year.

At present the lack of sunlight has not been an issue, although once the scheduled 25 FFA (soccer) matches and a possible seven Super 15 games take their toll, MOPT will be looking to use the supplementary lighting and covers to aid turf recovery and growth.