

SAPIA CODE OF PRACTICE



**FOR THE INSTALLATION AND MAINTENANCE OF
IMPACT ATTENUATING SURFACING SYSTEMS FOR
PLAYGROUNDS**

Wet Pour Rubber
Artificial Grass
Natural Turf
Loose Fill
Unitary Products
Multi-Layered Unitary Systems

Sports & Play Industry Association

As the recognised Australian trade association, SAPIA fosters excellence, professionalism and continuous improvement throughout the sports and play construction industry, in order to provide the high quality facilities necessary for the success and safety of Australian sport and recreation.

SAPIA's Aims and Objectives

- To promote high standards of design, construction and workmanship for sports and play facilities in Australasia.
- To regulate the industry through the vetting and monitoring of SAPIA members.
- To participate fully in the development of Australasian and other Standards for the construction and performance of sports, play and recreational facilities, for all levels of ability.
- To liaise closely with the governing bodies of sport, play and recreational facilities, both nationally and internationally.
- To encourage the use of new technology in the design and construction of sports and play facilities.
- To provide and support training and education for the industry's workforce.
- To provide a strong voice for the sports and play construction industry in Australasia.

www.sapia.org.au

The SAPIA website provides a wealth of valuable information for anyone involved in the development of sports and play facilities. Visit www.sapia.org.au for Industry News, Technical Guidance, Exhibitions & Events, the SAPIA Membership Database and more. Visitors are invited to subscribe to the free SAPIA News Update service, for regular news bulletins.

Further information

The Sports and Play Industry Association operates through its own full-time administration. For further information, including a list of members, please contact SAPIA at the address below.

Sports & Play Industry Association
PO Box 118, Mona Vale NSW 1660 Australia
Telephone: 1800 208 202 (freecall AUSTRALIA)
Telephone: 0800 208 202 (freecall NEW ZEALAND)
E-mail: office@sapia.org.au
Web: www.sapia.org.au

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Mark Cunningham	Synthetic Grass & Rubber Surfaces Australia Pty Ltd
Brett Evans	RubberTough Industries Pty Ltd
Grant Humphreys	Acousto-scan Pty Ltd; Playtest Pty Ltd
Spencer Wallace	Glooloo Surfacing Pty Ltd
Mark Weber	Surfacing Contractors Australia Pty Ltd
Robyn Wilcox	Sports and Play Industry Association Limited

Front Cover Picture: Moncrieff Recreation Park ACT: IAS By Bruce's Playgrounds

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Introduction

The Sports and Play Industry Association (SAPIA) has produced this document to provide prospective clients and specifiers with guidance on the basic construction requirements, specifications and maintenance currently employed in constructing Wet Pour impact attenuating surfacing in playgrounds.

This document calls on the experience of our member companies who have constructed a wide range of installations for a variety of clients over many years. The requirements of the relevant Australian Standards are also incorporated, where appropriate, in the document.

Whilst it is not intended that this document should become part of a contract, it is hoped that it will prove useful in the selection of an appropriate system and surface and form a useful reference in the design and construction process.

Standards Australia has released a suite of standards in recent years:

- | | |
|-------------------------|--|
| AS 4685:2014 Parts 1-11 | Relating to playground equipment and surfacing; |
| AS 4422:2022 | Playground surfacing – specifications, requirements and test methods; |
| AS 4685.0:2017 | Playground equipment and surfacing development, installation, inspection, maintenance and operation; |
| SA TR CEN 17519:2021 | Surfaces for sports areas – Synthetic turf sports facilities – Guidance on how to minimize infill dispersion into the environment. |

Please note: Users of the Code of Practice are advised to ensure that they are fully aware of any further technical requirements or criteria which may be imposed by a specific funding body for individual facility development projects.



Thornlands Community Park Stage 2: IAS by Surfacing Contractors Australia (QLD)

Notes to be read in conjunction with this Code of Practice:

- This Code of Practice is intended for use by surfacing contractors, play facility design professionals and play facility purchasers and owners. The Code of Practice should not be used as a substitute for carrying out appropriate surveys and obtaining professional advice in individual circumstances. Although the Code of Practice has been produced by reference to facilities constructed under normal climatic conditions in Australia, the Sports and Play Industry Association cannot accept any responsibility whatsoever for any loss, damage or injury whatsoever arising from reliance on the specifications within the Code of Practice.
- The Code of Practice provides minimum guideline specifications which members of the Sports and Play Industry Association are committed to meet. As guideline specifications, however, they do not supersede a reasonable interpretation of the specification and terms of contract applying in each contract [or the relevant requirements of the Australian Building Codes or Building Act. For individual projects, variations in climate, soil conditions, topography, equipment design and other site-specific conditions may necessitate standards of specification greater than those recommended in this Code of Practice.
- Parties not experienced in play facility construction are strongly advised to consult qualified contractors and/or consultants. The Sports and Play Industry Association can provide details of experienced contractors and consultants.
- In accordance with common practice within the construction industry (used, for example, in AS2758: Concrete Aggregates) the depth of any individual construction layer is specified within the Code of Practice as the nominal compacted depth. The nominal depth can be regarded as the design depth of a layer of construction within a surfacing system.
- The information contained within the Code of Practice, whilst accurate at the time of publication, may be subject to change at a future date. Due to changing technology and new developments in construction methods, as well as the changing requirements of the Standards and Building Codes, revisions to the recommendations are likely, and only the most recent edition of the Code of Practice should therefore be used.
- A permanent joint committee will keep under review the use of the Code of Practice and will consider any suggestions for amendment, which should be addressed to the President, Sports and Play Industry Association. Revision to the Code of Practice will be made when it is considered appropriate.
- Due to many of the processes used in constructing surfacing systems being highly susceptible to weather conditions such as temperature, humidity, rainfall etc., it is advisable to check with the specialist contractor as to the most suitable time of year for the installation of their proprietary product.



N1 Spring Farm Playground NSW: IAS by Glooloo Surfacing

Prologue

From the first considerations regarding the construction of a playground surface through to final completion, a clear understanding is required of the process. The processes and decisions that need to be made can be complex and will depend upon many contributing factors.

This Code of Practice has ten main sections that cover requirements and provide technical information on the installation and maintenance of an impact attenuating safety surface used in the construction of playgrounds.

SECTION 1: OVERVIEW OF IMPACT ATTENUATING SURFACING SYSTEMS

Introduces the various safety surfaces available at present and explains how this document can be used throughout the construction of the playground surface. It also underlines issues of which the reader must be made aware.

SECTION 2: STANDARDS AND SPECIFICATIONS

Refers to standards and specifications, outlines the main standards set by Standards Australia and the range of tests the surface must pass to satisfy the safety and performance criteria. Even though every effort is made to ensure the Code of Practice is up to date, SAPIA highly recommends that the Standards are checked via the original source to ensure they cover the very latest requirements.

SECTION 3: BASE CONSTRUCTION

Covers the construction of the base structure, outlining the general requirements that need to be in place.

SECTION 4: SURFACING INSTALLATION

Provides guidance on the installation of the various IAS surfacing systems. It provides information and technical guidance on methods of installation, surface levels, jointing and the quality of the finished installation.

SECTION 5: MAINTENANCE

Refers to the maintenance of a finished playground surface. It covers issues from infill migration mitigation, moss and algae to general cleanliness and what could be done in the case of snow and ice.

SECTION 6: END OF LIFE

Covers life expectancy of the various systems, removal of surface and disposal options.

SECTION 7: WARRANTY

Warranty of a newly installed surface is detailed in this section. The responsible party is outlined along with the general conditions of the warranty.

SECTION 8: LIMITATION OF THE SURFACE SYSTEM

This section deals with the limitations of the systems so that specifiers and end users are aware. It also includes best working practices to avoid infill migration, incorporation of shade.

The diagram on the following page is designed to help potential clients make the correct decisions at the right times by looking at the ideal routes a project may take from proposal to completion and the information required at each stage.

Please note: depending on the size and cost of a project, the full process outlined below will not be necessary. For example, small projects may not need to employ a consultant or indeed go through the same level of pre-build surveys. Many projects will involve a design and build element from the contractor and will consequently follow a different plan.

CONSTRUCTION OF A PLAY SURFACE

1. Project Brief	This phase reviews the project brief and considers factors such as: location, usage, funding, procurement and project management.
2. Project Feasibility	This phase can include the development of a business plan, planning application and funding application. A consultant can be appointed during this phase if required, this will normally be for a large project.
3. Site Investigation	Prior to the design phase, a detailed site investigation is required. This includes topographical, geotechnical, electrical and drainage surveys. This may not be necessary on a small project.
4. Design Specification	This phase includes the production of full design specifications and technical drawings.
5. Tender Process	In this section a review of the tender submissions is undertaken. This includes tender evaluation, short-listing and eventual contractor selection.
6. Construction Period	This phase includes the construction of the facility. If required, independent quality control is undertaken to assess build quality and design specification conformity.
7. Project Completion	This section includes the hand-over of the completed project. If required, performance testing should be undertaken to ensure compliance. Additionally, a maintenance regimen should be provided by the installer.
8. Aftercare	This phase includes the ongoing maintenance programme and warranty period of the installation. As required, performance tests are undertaken to monitor surface behaviour.

Definitions

For the purpose of this Code of Practice the following definitions apply:

Impact Attenuating Surfacing (IAS)

A surface, whereby the kinetic energy of an impact is dissipated by localized elastic hysteresis, deformation, dislocation or displacement such that the maximum acceleration and head injury criteria (HIC) is reduced and the head injury criteria duration (time) is increased.

An impact-attenuating surface consists of one or more material components (such as shredded rubber bound together with urethane formed into a sheet, tile or other continuous surface where the underlying protective properties of the impact surfacing changes little with consecutive and/or repeated use.

Artificial grass

Artificial grass, also called synthetic turf, can be defined as 'a surface comprised of a carpet of tufted, knitted, woven, needle punched or fibre bonded construction whose pile is designed to replicate the appearance and behaviour of natural grass'.

Asphalt

A mixture of bitumen and stone, it is often used as the generic term for road surfaces.

Base Course

If there is a sub-base course (see definition below), the base course is constructed directly above the sub-base. Otherwise, it is built directly on top of the sub-grade.

Bitumen

A sticky, black and highly viscous liquid or semi-solid, composed almost entirely of petroleum.

Building Code of Australia (BCA)

Set of standards for the building industry of Australia.

Competent Person

A person who has, through a combination of training, education and experience, acquired knowledge and skills enabling that person to correctly perform a specified task.

Critical Fall Height (h_c)

The maximum free height of fall for which a surface will provide an acceptable level of impact attenuation.

Drop Height

The distance between the test position on the surfacing and the lowest point of the free falling missile prior to release.

Drop Test (laboratory testing)

A minimum series of four impact measurements carried out from increasing fall heights, such that at least one measurement gives an HIC value above 1000, a g_{max} value above 200 or $(t_1 - t_2 > 3ms)$.

Falling Space

Space in, on or around the equipment that can be passed through by a user falling from an elevated part of the equipment.

Free Height of Fall (h_f)

The greatest vertical distance from the clearly intended body support to the impact area below.

Free Space

Space in, on or around the equipment that can be occupied by a user undergoing a movement forced by the equipment (e.g. sliding, swinging, rocking).

g_{max}

The multiple of the acceleration (g) into gravity at the earth's surface at sea level that represents maximum acceleration experienced during impact.

Head Injury Criteria (HIC)

A measure of impact severity that considers the duration over which the most critical section of the deceleration pulse persists as well as the peak level of that deceleration.

HIC Duration

The time interval over which the HIC is calculated, i.e. (t₂ - t₁). Where (t₂ - t₁) are the initial and final times in seconds of the interval during which HIC attains a maximum value, and acceleration a is measured in terms of g. If (t₂ - t₁ < 3ms) then the impact is considered invalid and the test will be restarted for a lower drop height. The shock pad surface is not classed as an impact attenuation surface if (t₂ - t₁ < 3ms) or g_{max} >200. Note: The (t₂ - t₁) are two intermediate values of time between t-start and t-end attaining the maximum HIC value.

Impact Area

Area that can be hit by a user after falling through the falling space.

Impact Attenuation

Property whereby the kinetic energy of an impact is dissipated by localized elastic hysteresis, deformation or displacement.

Impact Measurement

The HIC value from the recorded acceleration of the missile falling from one fall height onto one test position.

Loose-Fill Surface Materials

Surfacing material supplied for the purpose of impact attenuation in playgrounds, consisting of unbound, granular, chipped or fibrous elements such as sand, wood-fibre, bark mulch, wood chips or other materials. These may be organic or inorganic.

Measured Fall Height (h_m)

The height from which a single drop is conducted h_f (being the free height fall with a minimum additional 10% allowance) to determine the HIC, g_{max} and HIC duration of the surface under test at a particular location. At the measured fall height the HIC and the g_{max} will be less than or equal to 1000, less than or equal to 200g, and (t₂ - t₁ < 3ms) respectively, for a satisfactory result.

Minimum Space

Space required for the safe use of equipment, comprising falling space, free space and space occupied by the equipment.

Playing Surface

Surface of a playground from which the use of the playground equipment commences and which comprises at least the impact area.

Poured In Place (PIP)

See "Rubber Play Surface".

Rubber Play Surface

This is a seamless rubber surface composed of two layers that is poured in place. The first layer, or "wear layer", is typically 12mm -15mm thick and made of SBR coloured, EPDM or TPV granules. The second layer, or "cushion layer" is 20 -80mm thick.

Shockpad Base Impact Layer

Made from rubber and the thickness will depend on the CFH required for the surface.

Soft Fall Surfacing

Generic name for Impact Attenuating Surface (IAS).

Sub-base

Is the layer of aggregate material laid on the sub-grade, Sub-base is often the main load-bearing layer of the pavement. Its role is to spread the load evenly over the sub-grade.

Sub-grade

Is the natural ground underneath a constructed surface.

Test Position

A position on the material to be tested, located perpendicularly below the centre of the missile.

Shockpad Base Impact Layer

Made from rubber and the thickness will depend on the CFH required for the surface.

Top Layer (Wearing Layer)

Top layer made from rubber products 15mm thick.

Unitary surface

See IAS.

Wet Pour Rubber

Generic name for Impact Attenuating Surface (IAS). Same as PIP (see above) or Polymeric Surfacing.



Glenelg Foreshore Playground: IAS by Surfacing Contractors Australia (SA)

1 Section One: Overview of Impact Attenuating Surfacing Systems

1.1 Wet Pour Rubber

The following is a list of the minimum requirements that the end user should expect from their wet pour rubber safety surface:

- Complies with or exceeds the requirements of AS4422:20 22 and AS4685:2014 Parts 1-11.
- Reduces the risk of playground head injuries.
- Has high durability and a long-term life span.
- Should be an all-weather surface – semi-permeable, allowing quick drainage of water [at least 500mm / hour], therefore faster reuse of the surface.
- Contains no tripping hazards.
- Has no inhalation concerns: the surfacing shall not contain any component known to present an inhalation hazard to users, e.g. sawdust or finely shredded granulated rubber. Refer to AS 2985 and ISO 7708, Annex B. Table B1 for more detailed information on inhalation hazards.
- Contains materials that best manage UV stability based upon Australian conditions.
- Has high anti-slip properties.
- Has equal access for disabled and mobility impaired users, must comply with the Disabilities Act.

SAPIA recommends that wet pour rubber safety surfacing system designers and installation companies should have as a minimum the following requisites:

- Relevant and current trade licences.
- Relevant and current memberships of appropriate associations and industry bodies.
- Current system Impact Certificates as per AS4422:20 22 and AS4685.0.
- OH&S / WHS policies and systems.
- Relevant Safe Work Method Statements.
- Product and Public liability insurance of AUD 20 million minimum, endorsed for playground impact system design and installation.
- Relevant Warranty Statements and Maintenance documents.

Wet Pour systems incorporate varying rubber granules bound in a polyurethane resin and constructed in single or bi-laminate configurations of varying thicknesses and materials to achieve certifiable impact performance to AS4422:20 22 and laid with appropriate “fall zones” to achieve certifiable performance to AS4685:2014 Parts 1-11. These surfaces, dependent upon design specifications, will differ in performance between each company’s individual design specifications. It is advised that specifiers and end users research the design specifications of the proposed contractor to ensure the correct system is used and design thicknesses are incorporated correctly in relation to finished level heights and drainage requirements. If the performance requirements are unknown or not specified, please refer to the equipment manufacturer.

It is **not** recommended that specifiers nominate thicknesses in their specifications rather than performance requirements needed in relation to AS4422:20 22 and AS4685:2014 Parts 1-11. If specifiers nominate thicknesses, they should be aware that they are taking legal onus for performance and will be liable for any actual non-performance that may be achieved by the surface.

Many different Wet Pour in-situ systems exist in the Australasian market but all utilise the basic material content of polyurethane resin binder and rubber granulate. The granulate may be manufactured from recycled truck and car tyres (i.e. Styrene Butadiene Rubber, SBR) or from EPDM (Ethylene Propylene Diene Monomer), Thermoplastic Vulcanizates (TPV) or Thermal Plastic Granule.

Base Impact Layers are constructed using a variety of SBR rubbers that are derived from post-consumer whole tyre reduction and retreading industries. General sizings used are 8-15mm, 8-10mm, 4-8mm, 4 mesh and 8 mesh. Different sizings and hybrid mixtures will be used by system developers to enable differing performance requirements.

The Base Impact Layer is generally mixed with a single pack aromatic MDI based polyurethane rubber crumb binder. Each system designer will use varying ratios of binder but as a general rule the ratio should be between 6 and 8% by weight of rubber.

The thicknesses and make up of these layers will vary dependent upon the required impact performance needed and will be bound by varying percentages of polyurethane binder.

Top Layers [wearing layers] are made up of a variety of either recycled SBR materials or synthetic rubber materials dependent upon the cost and performance parameters of the client.

The Top Layer [wearing layer] in most cases is generally mixed with a single pack aromatic MDI based polyurethane rubber crumb binder. Each system designer will use varying ratios of binder but as a general rule the ratio should be approximately 20% by weight of rubber.

Installers may opt to use modified binders to increase or decrease cure time dependent upon the seasonal climatic conditions. They also may opt to modify viscosity of the binder subject to winter or summer installation conditions. These modifications should only be carried out by the binder manufacturer at point of manufacture and not by adding agents on site.

To decrease yellowing of the composite rubber/binder mix due to UV degradation, an Aliphatic binder may be used in any application. This binder is considerably more expensive and uses the same rubber/binder mix ratios as noted previously. Please note these binders will diminish yellowing but will not completely stop it.

Nominally the top layer should be 15mm in thickness. The following are the various Top Layer materials available in the marketplace:

Site Coloured SBR: This is a black 1-3mm or 1-4mm SBR granule or 12 mesh SBR shred that is coated with polyurethane and powdered oxide pigments on site. This system is the cheapest and the exterior colour coating will wear over time. Basic three to four colours are available.

Precoated SBR: This is a black 1-3mm or 1-4mm SBR granule or 12 mesh SBR shred that is coated with polyurethane and dispersed liquid pigments in a factory situation. This is normally a two-coat process and due to the controlled environment a much greater range of colours is available. Due to the additional coatings, external colour wear is much slower but eventually the surface colour will also wear.

EPDM, TPV: These are synthetic manufactured granules in 1-2mm, 1-3mm or 1-4mm sizings. Impact performance is slightly less than SBR systems. Colour is completely through the matrix so they do not suffer from colour abrasion as per the previous two products. Certain bright colours [made from organic based pigments] will fade quickly under Australia's UV conditions.

Thermal Plastic Granules: These are synthetic plastic granules of 1-2mm and 1-3mm sizings, mainly used as a single layer system. Impact performance is slightly less than products listed above. Certain colours will also fade.

Note 1: Polyurethane rubber crumb binders are susceptible to temperature and humidity, therefore it is recommended that the installation of in-situ systems does not take place when the ambient temperature is outside the range 4°C to 35°C or the relative humidity exceeds 90%, unless the specialist contractor has previously provided a written assurance that this range can be exceeded without detriment to the product.

Note 2: Only experienced operatives should be employed to install Wet Pour surfacing and a Safe Work Method Statement [SWMS] assessment is required as part of the Health and Safety plan for the project.

Note 3: Standard Wet Pour laid surfaces and their bases are designed for pedestrian loadings only. It is possible to modify the systems to enable heavier design loads but this should only be done by experienced surfacing system design and installation companies.

1.2 Artificial Grass

Artificial grass can be defined as 'a surface comprised of a carpet of tufted, knitted, woven, needle punched or fibre bonded construction whose pile is designed to replicate the appearance and behaviour of natural grass'. With pile heights ranging from 10mm (tennis) to 60mm (football and rugby) there are many different types of synthetic turf with a range of properties, and advantages and disadvantages. Variables include the polymer used for the fibre yarn (such as polyethylene and polypropylene), the cross-sectional area of the individual ribbons of fibre, the method of carpet manufacture, pile height, pile density and choice of infill.

Historically, the majority of artificial grass playgrounds have been surfaced with tufted sand filled carpets. Experience has shown this form of carpet to have good durability and performance when used in the extreme wear conditions which are often experienced in playgrounds. The development of longer pile (3G) surfaces has, however, increasingly seen these types of surfaces being used when football or rugby are the principal sport.

Irrespective of which type of synthetic turf is selected, in order to ensure the surface has acceptable durability and resistance to weathering, it should satisfy the laboratory and if required field test requirements of EN 15330-1 (2013 edition).

Non-filled (often called water-based)

The original (or first generation) form of artificial grass surfaces are manufactured with a short dense pile. Now primarily used for top-level hockey, most unfilled products require the use of water to provide acceptable levels of foot grip (considered too high when dry). They are now often referred to as 'wet fields' or 'water-based'. The water is applied via an irrigation system to the surface immediately before play. The presence of water reduces the player/surface friction, modifies the speed of the hockey ball and cools the surface in hot climates. New technologies are now seeing the development of non-filled surfaces which are not designed to be used after the application of water. These surfaces will potentially be designed for playing a combination of football, rugby, hockey, netball and tennis.

Sand-filled

The second generation of artificial grass has a longer (typically 18 - 25mm) and more open pile structure than non-filled surfaces. This allows the carpet pile to be filled with sand and provides a durable, cost-effective surface that can be used for a number of sports at a reasonable level of play. There are also shorter pile products made specifically for tennis and playgrounds (typically 10 – 15mm) with a denser pile structure and less sand infill.

Most carpets are tufted from polyethylene, polypropylene or mixed co-polymer yarns and are infilled with a non-abrasive, well-rounded silica sand that is dust-free and of uniform grading and density. The sand infill is normally to within 2-3 mm of the fibre tips. As the sand and fibre combine to provide the characteristics of the playing surface it is essential that the level of sand fill is maintained throughout the life of the facility.

Sand-dressed

A derivative of the sand-filled system are 'sand-dressed' carpets. These are carpets with a shorter, denser pile than the standard filled grass systems with a reduced quantity of sand fill. Sand-dressed systems are commonly specified as alternatives to the water-based for hockey.

Long pile – 3rd generation (3G)

The 'third generation' system of artificial grass has been designed to replicate natural pitches used for football and rugby. It has become popular with the governing bodies of both sports and has been approved for football and rugby at the highest level (see FIFA and World Rugby requirements). Surfaces falling into this category differ from standard sand-filled systems in the height of pile, commonly from

40mm up to 60mm, and the level of infill, normally 2/3 of the pile height. The infill to the 3G system is normally designed to provide all of the shock absorbing properties (when a shockpad is not incorporated into the surfacing system) and comprises granules that are incorporated with sand in layers to provide the required stability and performance.

Due to concerns surrounding the loss of this infill material into the surrounding environment as a result of a combination of usage and maintenance, there have been calls for improvement in facility designs to prevent this loss of infill. The European Standards Committee (CEN) has produced a Technical Report on 'Guidance on how to Minimise Infill Dispersion into the Environment' (2020). This has been adopted unchanged in Australia as SA TR CEN 17519:2021. It is important that the designs to minimise infill dispersion are incorporated into the overall design to the artificial grass surfaced playground.

Needle-punch (Type 9)

Needle-punch carpets have been utilised as a multi-use surface for fields and playgrounds for a considerable time as they provide an alternative to sand-filled / dressed artificial grass surfaces and offer good playing characteristics and durability. They normally range from 8-16mm in thickness and have a sand filling applied after installation. Some systems are bonded to the porous asphalt base and others are loose laid.

To ensure that any of these types of artificial grass surfacing has acceptable durability and resistance to weathering, the products should satisfy the laboratory and, if applicable, field test requirements of CEN EN15330-2.



Elara Park Playing Fields Play Space NSW: IAS by Synthetic Grass & Rubber Surfaces Australia

1.3 Shockpads under impact attenuating surfaces (IAS)

The introduction of a resilient layer between the base construction and the IAS is used to provide a degree of comfort to players and to create defined performance and safety requirements for specific sports. There are a number of ways of achieving this resilient layer, with assorted in-situ laid shockpad

systems, prefabricated or combinations of both. Typical components of in-situ systems are rubber crumb/shred mixed with a resin binder, which are mixed on site and laid to form a continuous layer of material. In the case of pre-formed systems, the shockpads are delivered to site as rolls or tiles of prefabricated material.

1.3.1 Prefabricated construction of shockpads

The type and thickness of the shockpad will be dictated by the priority sport, although several different options may be able to provide a surface system that complies with playing characteristic requirements. Normally supplied as flat rolls or as inter-locking tiles, these types of shockpad generally have a thickness in the range 10-23 mm.

Whichever shockpad system is installed, a reference sample should be obtained at tender negotiating stage so that the installed shockpad can be checked for consistency of material. The shockpad installed should be done in accordance with the manufacturer's instructions.

Each type of shockpad has different features and benefits which the manufacturer will confirm and demonstrate before a choice of system is made. Careful evaluation of prefabricated systems and laying processes is essential when making comparisons between products. Product testing to AS4422:2022 is required prior to installation.

1.3.2 In-situ construction of shockpads

Shockpads constructed in-situ normally vary in thickness from 15mm to 130mm and consist of a polyurethane binder mixed with rubber crumb/shred. Some thicker pads also may contain pea gravel or other smaller aggregates. The rubber particle shape, size and grading needs to be considered along with the binder type and content. There are also shockpad/base systems formed using recycled materials which can be considered.

The precise specification and laying techniques will vary depending on the installer and the priority sport. As with prefabricated pads, no joint should vary in level by more than 2mm and the completed surface should comply with the level tolerance requirement of the finished installation.

Careful monitoring procedures and quality control checks should be in place to ensure that any variations in thickness and binder content of an in-situ laid pad do not affect the playing performance and compliance with AS 4422:2022.

1.4 Natural Turf

Natural grass is not recommended as a playground surface. NOTE: Where the provided surface relies wholly or partly on naturally occurring soil or grass substrate, the critical fall height test result will likely vary over time or with climatic conditions. As these types of surfaces are not scientifically controlled, it is advised to base their ongoing use on a risk assessment every six months, rather than the strict pass/fail test results to AS4422. The fees for the ongoing risk assessments will add substantially to the owner's costs.

1.5 Loose Fill Materials

Loose fill is defined as surfacing material supplied for the purpose of impact attenuation in playgrounds and which consists of unbound granular, chipped or fibrous elements such as sand, wood, fibre, bark mulch, wood chip or other materials. These may be organic or inorganic. Note:

- Materials of the correct granulometry and certification are suitable to be used at a minimum depth of 200mm for FHO of less than 2,000mm and 300mm for FHO of less than 3,000mm.
- These loose particulates should have an additional 100mm depth added to compensate for displacement and compaction.
- No silty or clay particles should be contained in the material.
- Loose fill materials are extremely susceptible to scuffing and displacement which may result in the material becoming too shallow or compacted to provide the required impact attenuation.

- The depth of loose fill material shall be regularly measured and topped up to compensate for compaction, loss, and dispersion especially in heavy use areas. NOTE: As a supplement to loose fill in intensively used areas, unitary surfacing (wet pour rubber) may be installed to reduce the impact of wear under equipment, e.g. under the swing seats, at the end of the slide and the base of the fireman's pole. These should be placed with care and be large enough to avoid catching the feet of users in motion.
- Loose fill material should be raked at regular intervals to decrease compaction and dispersion and for removal of deleterious foreign materials such as litter, sticks, syringes or other potential hazards.



Jubilee Reserve Wyndham Vale VIC: IAS by Rubbertough Industries

1.6 Unitary Products

These are factory made pre-formed pavers, tiles or sheets that are made from either rubber, foam, or a mixture of these materials (10–130mm thick). These products can also be used under wet pour rubber and artificial grass systems.

- Ensure they are laid on a suitably prepared substrate with correct drainage and compaction.
- Ensure these are installed as per the manufacturer's instructions and are certified compliant to the required FHOF needed.
- Adding subsequent layers to the compliant item may in fact affect the impact performance of the overall composition and may void the original stated impact compliance.
- These products by nature of their manufacture may alter dimensional shape over time and can shrink and distort. This may lead to maintenance issues.

1.7 Multi-Layered Unitary Systems

Multi-layered unitary systems include rubber unitary shock pads with wet pour rubber overlay. Note:

- Ensure the substrate is level across both planes and contains crossfall for drainage purposes and is compacted.
- Ensure the unitary shock pad is installed as per the manufacturer's specification. Failure to do this may result in reflective cracking through the wet pour top layer.
- Ensure that the complete system is tested for impact attenuation compliance to AS4422 as the top layer may alter performance [both ways] of the unitary shock pad.
- Wet pour rubber / unitary shock pad / composite foam underlay with artificial grass overlay: ensure all grass seams are glued fully and no fixing nails are used.
- Ensure suitable edge detail is installed to negate any tripping hazards.

2 Section Two: Standards and Specifications

In Australia, adoption of Standards is voluntary. The exception to this is when a Standard is legislated by law, e.g. the Building Code of Australia [BCA] which is an amalgamation of many Standards, AS3000 Electrical Design Standard and numerous automotive Standards.

If a Standard is noted in a legal document or contract (tender), the parties noted in the contract are legally bound to enact the requirements of the Standard.

Local authorities and companies have a duty of care to comply to Standards.

Insurance Companies, Public Liability and Workers Compensation Insurances also require compliance to standards as a requirement of their policy conditions.

To satisfy safety and performance criteria, playground surfaces are subjected to a range of tests. This section provides details of the test methods from the most up-to-date available Australian standards (as at May 2023).

Please note: Whilst the information presented in this section is taken from the relevant Standards, it is highly recommended that information is obtained directly from the source material to ensure it meets the very latest requirements as these documents are updated on a regular basis. Every effort is made to keep this Code of Practice up-to-date but there will always be a delay in response to updates.

2.1 Current Standards

2.1.1 Australian Standards

The Australian Standards that currently apply to impact absorbing surfacing are as follows:

- AS4685.0:2017 - Maintenance and Inspection of Playgrounds
- AS4685:1-11 2014 – Parts 0 to 11 - Playground Equipment and Surfacing
- AS 4422:2022 - Impact Absorbing Surfacing: Safety Requirements and Test Method

- **Extract from Standard: AS4685.0:2017 - Maintenance and Inspection of Playgrounds**

Regular testing of impact attenuating surfaces.

As a minimum, the unitary surfacing shall be tested in accordance with AS 4422 before opening the playground to the general public and every three years.

Loose-fill surfaces do not need to be impact-attenuation tested on a regular basis provided—

(a) the generic product complies with the requirements of AS 4422 when tested;

(b) the loose-fill material has been installed to a depth of at least 300 mm and maintained so that it never drops below 200 mm.

NOTE: AS4422:2022 Appendix D contains examples of organic impact attenuating surfaces and guidance on pass/fail selection."

2.1.2 Calibration Measuring Device AS4422:20 22

Testing in accordance with this Standard shall be undertaken by a laboratory that fulfils the requirements of AS ISO/IEC 17025.

Note 1: A laboratory may demonstrate that it fulfils the requirements of AS ISO EC 17025 through accreditation as a signatory member of the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) with a relevant scope of accreditation to cover the tests being performed.

Note 2: In Australia, the signatory member of the ILAC MRA is the National Association of Testing Authorities, Australia (NATA).

The supplier of the Wet Pour IAS must supply the client with a test report from an independent NATA ILAC registered test laboratory who is preferably a member of SAPIA.

- **Extract from Standard: AS4685.0:2017**

Within the impact area, to allow for compaction and dispersion, loose-fill material shall be installed to a depth of at least 300 mm and not allowed to drop below 200 mm.

NOTE: As a supplement to loose fill, in intensively used areas, unitary surfacing may be installed to reduce the impact of wear under equipment, e.g. under the swing seats, at the end of a slide and the base of a fireman's pole. These should be placed with care and be large enough to avoid catching the feet of users in motion.

The particle shape, sieve grading and the inclusion of clays within sands will affect the impact attenuation properties. Not all sands will be suitable for impact attenuation.

2.2 Critical Fall Height

2.2.1 Australian Standards for Impact Absorbing Playground Surfacing

AS4422:2022 limits the tolerance level on impact with a surface to a Head Injury Criteria (HIC) of 1000. This limit is based on extensive research aimed at reducing deaths and permanent injuries due to head impacts. These limits were never intended to prevent other forms of injury such as long bone fractures, etc.

Compliance with AS4422:20 22 does not mean that injuries in the playground will be eliminated. "IAS cannot prevent accidents. They may, if correctly installed, reduce the seriousness of injury. Providers should consider surface materials as one of a range of design elements in the development of a safe and successful playground."

Critical Fall Height Value: The Critical Fall Height for a specific surface thickness is defined as the thickness of surfacing required to limit the HIC and the gmax will be less than or equal to 1000 HIC, less than or equal to 200g, and greater than 3 ms for T₁ and T₂ respectively, for a satisfactory result. (See Appendix A.)

2.2.2 Free Fall Height Comparison

The Critical Fall Height, as stated on the test certificate (see 2.1.2) should be equal to or greater than the 'free height of fall' (FHOF) of the item of play equipment under which it is installed. The free fall height should be provided by the equipment supplier/manufacturer or calculated from AS4685:1-11.

2.2.3 Maximum Free Fall Height

The maximum free height of fall for an item of play equipment is defined in the standard as follows:

- For equipment on which the child stands, it is the height of the foot platform above the ground, regardless of whether there are higher guard rails.
- For equipment on which the child hangs, it is the height of the hand support above ground level.
- For equipment on which the child sits, it is normally the height of the seat above ground level with the exception of swings (to-and-fro or rotating).
- For swings, both to-and-fro and rotating, it is the height of the seat when at an angle of 60 degrees from the vertical.
- The Standard suggests that low play equipment with fall heights of 600 mm and less do not require to comply with the Critical Fall Height requirements, but the surface below should have 'some impact attenuating properties'.

2.3 Extent of Surfacing

2.3.1 Australian Standards for Playground Equipment

The extent of surfacing required around each item of play equipment should, ideally, be provided by the equipment supplier/manufacturer. In the absence of this information the area should be calculated to conform to AS 4685:2014.

2.3.2 Height of Playground Equipment

The higher an item of equipment, the further away from the equipment the child could fall (Figure 1). Special rules apply to swings, slides, runways and carousels where there is horizontal movement of the equipment in use. Reference should be made to AS 4685 Parts 1-6 for details of these specific requirements. For static and rocking equipment (including see-saws), the protected area should extend at least 1.5 metres around the equipment. This applies to fall heights from 0.6 to 1.5 metres and thereafter the distance rises to 2.5 metres around the equipment at the maximum permitted fall height of 3.0 metres (Figure 2).

2.3.3 Low Free Fall Height Equipment

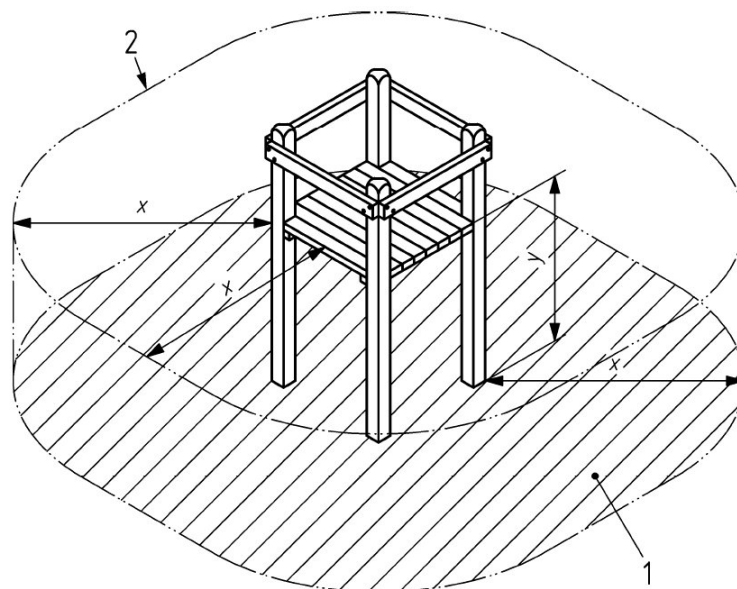
Where the item of equipment is less than 600 mm in free fall height, for instance a spring mobile, it is recommended that a 'nominal' thickness of surfacing be provided to a distance of at least 1.5 metres from the item of equipment. For slide 'run-outs' and roundabouts there are specific requirements contained in AS 4685 - 3, Section 4.8 and AS 4685 – 5, Section 5.2. Slide run out distance is 2000 mm from the end of the slide, CFH is 1000 mm.

2.3.4 Surface Tolerance (at the time of installation)

Where it is intended for the Impact Attenuating Surface to be laid either flat or to a uniform fall, any localised bumps or hollows shall be such that when a 3 metre long straight edge is placed in any position on the surface, the gap between the straight edge and the surface shall at no point be greater than 8 mm, nor greater than 3 mm when a 300 mm straight-edge is placed in any position on the surface.

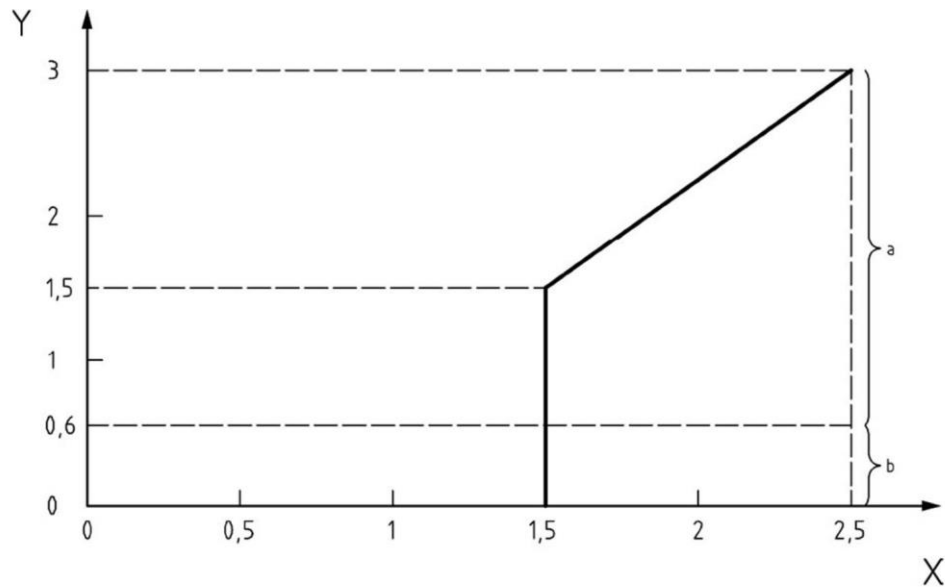
The finished IAS shall finish flush with the top of the surrounding edging and provide no tripping hazard. Steps in excess of 3 mm between the synthetic surfacing and the surrounding area (i.e. at edges of synthetic surfacing) will not be accepted.

Tolerances should be that of concrete etc., i.e. +/- 3mm from a 3 metre straight edge. Edges should conform to the Building Code - <10mm over 3m does not present a tripping hazard. Additionally, there shall be no ridge, groove, crease or change in surface texture anywhere on the area such that would be deemed to cause a trip hazard to users (with the exception of cases covered in Section 3.3).



- Key**
- 1 impact area
 - 2 falling space
 - x extent of falling space
 - y height of falling space

Figure 1 Falling Space Impact Area; after AS 4685-1 (2014)



If $0,6 \leq y \leq 1,5$ then $x = 1,5$ (in metres)

If $y > 1,5$, then $x = \frac{2}{3} y + 0,5$

Key

Y free height of fall

X minimum dimension of impact area

a impact attenuating surface with requirements

b surface with no requirements, unless there is forced movement

Figure 2: Extent of surfacing relative to free fall height; after AS 4685-1 (2014)

The table below shows the calculated values in tabular, rather than graphic format:

FFH	Falling Space	FFH	Falling Space
1.5m	1.50m	2.3m	2.03m
1.6m	1.56m	2.4m	2.10m
1.7m	1.63m	2.5m	2.16m
1.8m	1.70m	2.6m	2.23m
1.9m	1.76m	2.7m	2.30m
2.0m	1.83m	2.8m	2.37m
2.1m	1.90m	2.9m	2.43m
2.2m	1.96m	3.0m	2.50m

2.3.5 Other Recommended Tests to be included for Product Testing

These tests are recommended to have a material performance specification sheet as they show other properties that may be applicable for other surfaces (e.g. Netball friction requirement 75 BPT)

- Resistance to Abrasive wear
AS.2001.2.28
Wear Index less than 1.0
Wear ratio between 1.0 and 3.0

- Slip Resistance (see Figure 6)
AS4586. Slip resistance and pedestrian surfaces
HB198 2014 Slip Resistance for pedestrian surfaces
Not less than 40 when tested wet or dry (general foot traffic)
- Resistance to Indentation
AS 4693.1
The residual indentation shall be not more than 5.0 mm, nor shall there be any cracking, splitting or perforation around the point at which the load was applied
- Flammability
AS1530.4
The surface shall have a 'low' radius of effects of ignition
- Tensile Properties
AS.4693
For specimens cut from the upper wearing layer of a surfacing system, the tensile strength shall be not less than 0.4 MPa and the elongation at break shall not be less than 75 %. For specimens cut from any lower unexposed, supporting layer (where such a layer exists), the tensile strength shall be not less than 0.1 MPa and the elongation at break not less than 25%.

Note: Appendix A provides further details on these tests.



Wireless Bluetooth Impact Drop testing to AS4422 being performed by Playtest

3 Section Three: Base Construction

3.1 General

Impact Attenuating Safety surfacing systems can be laid on most existing hard surfaces such as quarry material, asphalt, concrete, timber, fibre cement sheet etc. which is in a good sound condition. Inspection of these bases should be carried out by experienced companies or individuals to ensure they are of suitable condition to accept the new surface. In some circumstances remedial works may be required to be carried out to enable the system to be installed on the existing base. In most situations this should still result in a cost saving for the client.

A good quality base is essential for a stable surface and to ensure maximum useful life from the surface installed.

When constructing a new play area, it is possible to lay the surface directly on a compacted quarry rubble base layer as a minimum requirement. The base layer should be constructed to the required construction Finished Floor Levels [FFL] and should be level across both planes incorporating falls of not less than 1% for drainage purposes. Materials used should be equivalent to CBR 2.1 quarry material. The base layer should be a minimum of 100 mm compacted thicknesses. Compaction should be no less than 98% dry density. If base build up is greater than 100 mm then compaction should be carried out in layers not exceeding 150 mm.

In most cases quarry material bases should never be installed using cement stabilised material, as this may lead to reflective cracking transferring through the surface layers if sub-grade materials are reactive.

The surface will be porous, therefore during construction of the base quarry or concrete layer consideration of falls needs to be given to suitable drainage points [i.e. garden beds, drainage sumps etc.] and in some cases drainage pits, drainage membranes, agricultural drainage systems need to be installed prior to installation of the system in accordance with site specific conditions.

3.2 Creating a New Base Structure

3.2.1 Site Levelling and the Sub-grade Formation

Turf, vegetation and topsoil should be removed to a minimum depth of 100 mm (or greater) until natural ground is encountered. Excavated spoil should be either stockpiled on site or removed to a registered waste facility, dependent upon the client's requirements.

All base levels should be dictated by the required finished surface level as detailed in design documents.

The exposed sub-grade should be compacted and levelled to a tolerance of +/- 20 mm and must provide a stable platform for the base layer. Any soft spots should be excavated until firm ground is encountered and backfilled and compacted as per the requirements of the base layer.

3.2.2 Weed Killing

Where necessary, and when specified, the area should be treated with an appropriate herbicide following the manufacturer's recommended dosage rates and method of application. Only suitably qualified individuals should apply herbicides.

3.2.3 Geotextile Membrane

In certain cases it may be necessary to provide a separation layer at formation level using a geotextile membrane to ensure that the clean stone base is not contaminated by formation materials.

3.2.4 Base Layer Formation

The base layer to any surface construction should be designed to meet the following criteria:

- It should be capable of supporting – and transmitting to the existing ground – the loads of all vehicles, plant, machines and materials to be used in the construction, without causing deformation of the site.

- After the rubber surface is installed, the base should be capable of supporting and transmitting all pedestrian loads on the surface without permanent or long-term deformation of the play surface. Such loads arise mainly from users and pedestrian-operated, lightweight maintenance equipment. In case of doubt, the installer should be consulted.
- It should ensure that water, whether rainwater or natural ground water, will drain away freely over the base material, either into the natural subsoil or into the drainage system.
- The base layer should be constructed using hard, clean, crushed aggregates, such as CBR 2.1 quarry material. The grading of the base material must be such as to provide stability. The material should be laid in layers not exceeding 150 mm, each layer being compacted before the next is laid and compaction density should be >98% dry density. The thickness of the base layer will depend on site requirements. The minimum compacted thickness of the base layer should be 100 mm. The base layer material should be well compacted such that, upon completion, there shall be no detectable movement or soft spots. The surface level tolerance should be within the range + 0mm – 10mm of the design level, and, when checked with a 3 metre straight edge, there should be no deviation greater than 10 mm.

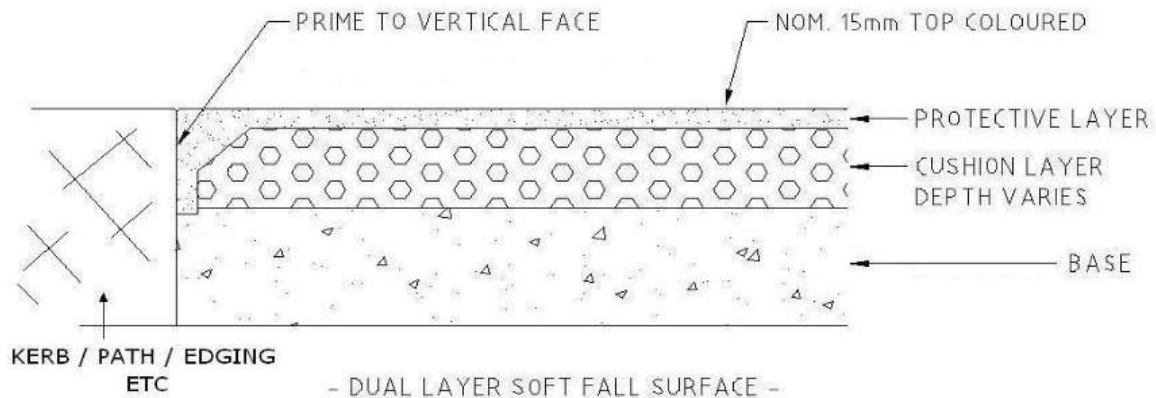


Figure 3: Typical Cross Section of Edge Detail

3.2.5 Perimeter Edging

The surface perimeter edging should take one of the following forms;

Concrete or Paver Edging – base layer should be excavated at junction of concrete edge/paver and rubber surface interface to form a thickened edge detail. top layer should roll down into thickened edge beam and should be wet primed at the interface of the concrete/paver – rubber junction.

level to abutting hardstand pavement of edge should ideally be flush, but must be within the tolerances of the Building Code so a tripping hazard does not occur.

Thickened Edge Beam – thickened edge beam detail is formed at the outer dimension of the surface and the top layer is rolled down into this forming a edge. This can be backfilled against with soil after the layer has cured.

Battered Edge Beam – when rubber surfacing is installed in conjunction with organic or sand softfall materials. A battered edge should be installed on the base layer at approximately 65 degrees, reaching the base of the organic/sand softfall excavation. The IAS layers should continue down this face in their entirety to the bottom of the organic/sand excavation to ensure that impact performance is achieved on this profile once the sand or bark material erodes and settles.

3.2.6 Structural Layer (Asphalt)

Bound asphalt bases are the traditional form of road construction as well as sports surfacing construction, consisting of a single course or two courses of open-textured bituminous asphalt to AS2150 (Figure 3). A typical specification would normally include the following:

Single-course construction: an open textured binder course consisting of 25 mm nominal compacted thickness (minimum compacted thickness not less than 20mm at any point) of 10mm nominal sized aggregate to AS2150.

The binder should be a straight run, 200 penetration, without cut-back oils and the materials should be laid and compacted to AS2150.

The surface tolerance of the asphalt layer should be in the range +0 mm – 5 mm of the design level, and, when checked with a 3 metre straight edge, there should be no deviation greater than 5 mm under a 3 metre straight edge placed in any direction.

Newly laid bituminous asphalt will have a glossy finish and some volatile oils may be present until the surface 'cures'. As the surface layer hardens it loses its sheen and it is recommended that the Wet Pour rubber surface layer is not installed until this curing process is complete, normally 30 days. If laid earlier, residual oils in the asphalt may react with the surface. [A high pressure wash using detergents is recommended if application is to be carried out prior to the normal curing period.]

3.2.7 Structural Layer (Concrete)

A structural layer may be constructed from 'no-fines' concrete. This will normally be a 15MPa, 6-10mm aggregate mix. No-fines concrete drains in the same way as open textured asphalt. The aggregate may be washed gravel or clean crushed rock, depending on availability. The minimum depth of the concrete layer should be 75 mm.

A structural layer may also be constructed from reinforced ready mixed concrete. This should be a minimum of 75 mm thick [although 100 mm is preferred] 20MPa concrete. Reinforcement should be a minimum of N62 mesh placed centrally or metal/plastic fibres.

During the early part of the curing process, the concrete must be protected from rain and from rapid drying. This may be achieved by covering with hessian or polythene for at least 24 hours after mixing. The surface tolerance of the concrete layer should be in the range +0 mm – 3 mm of the design level, and, when checked with a 3 metre straight edge, there should be no deviation greater than 6 mm under a 3 metre straight edge placed in any direction. In the case of a single layer Wet Pour rubber surface being installed onto the concrete base layer, it is recommended that this is not carried out until the concrete base layer has cured for a minimum of 30 days or when the optimum moisture content of the slab has decreased to <3%. Failure to do this will result in insufficient bond of the rubber surface to the concrete base layer and possible cross linking [foaming] of the polyurethane may occur causing the surface to de-bond and fragment.

3.3 Utilising Existing Hard Surfaces as Bases

3.3.1 General

Most hard surfaces such as asphalt, concrete, timber, fibre cement sheet, timber decking, tiles etc. will form satisfactory bases for a new Wet Pour rubber surface. If the new surface is designed to be porous, these base layers must have falls incorporated for drainage purposes as the surface system will be permeable. If there are no falls in the existing hard stands, then alternate drainage systems need to be investigated to ensure correct drainage. These systems are best investigated in conjunction with the site engineer or a consulting civil engineer.

Where existing equipment within a play area is being retained, ground clearance must be checked between the new Wet Pour rubber surface and the platforms of the equipment, e.g. at carousels, swings, etc., to ensure the requirements of AS 4685:2014 Parts 1-11 are met.

3.3.2 Edge Details for use with Existing Structural Bases

If the area of the surface is to be installed within a larger hard stand area, it is possible to cut a perimeter chase to ramp the new surface into rather than cut out and install perimeter kerbs (Figure 4). This ramp should be at a minimal gradient to avoid trip hazard and the limitations are as follows:

- For IAS of 50mm thickness and less, a maximum gradient of 1 in 2
- For IAS greater than 50mm thick, a maximum gradient of 1 in 2.5

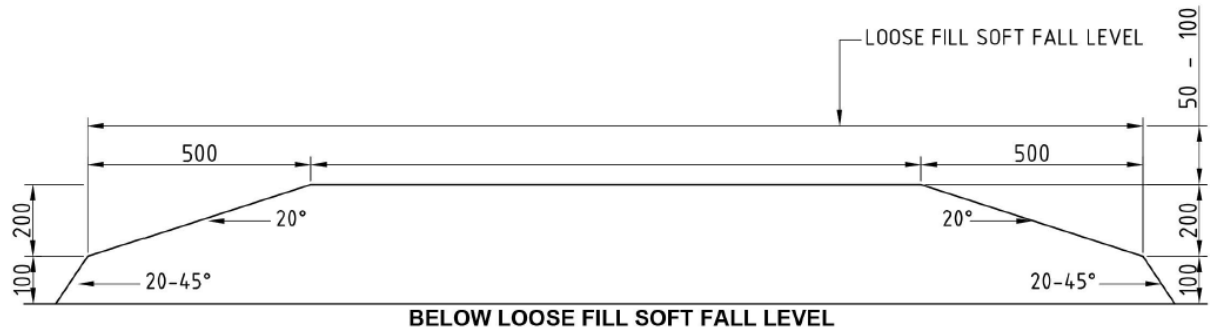


Figure 4: Edge Detail on Existing Hard Surface

Trip edges must be avoided and every effort made to minimise the slope at the edge of the new surface. The Disabilities Act suggests that, ideally, a maximum gradient of 1:12 is desirable and that for independent users of manual wheelchairs the maximum gradient should be 1:7, whilst for chairs pushed by a helper, the maximum gradient should be 1:5.

The minimum dimensions of the perimeter chase should be 100mm wide and 40mm deep. The installer should specify the dimensions of the ramped edge intended to be used for specific installations. The ramped edge should be additional to the area of IAS required and determined from Section 2.3.



Howard Park, Gregory Hills Playspace NSW: IAS By Synthetic Grass & Rubber Surfaces Australia

4 Section Four: Surfacing Installation

4.1 Installation Methods: Wet Pour Rubber, Unitary Products, Multi-layer Unitary Systems

4.1.1 Site Preparatory Work

- Ensure all correct plans and details are on hand.
- Ensure all fall zones and relevant impact layer thicknesses have been sprayed out on site.
- Ensure adequate site perimeter safety barriers have been installed. A minimum to be para webbing, but if possible 1800mm temporary fencing is preferred.
- Store materials in a manner to protect them from the general public and also damage from weather or site conditions.
- Inspect and ensure that the base preparation is correct in extent, material type, compaction and level requirements. If not, do not proceed until base is rectified to required standard.
- Ensure that the excavations to play equipment and shade structure footings have been filled to the required level [top of base preparation] with either concrete or compacted cement stabilised quarry material. If not, do not proceed with works until footings are rectified.
- Do not commence works if ambient temperature is below 4 degrees C or above 35 degrees C.
- Do not commence work if raining, as this will cross link the polyurethane.
- Do not commence work until all equipment legs and equipment that come into contact with the rubber mix have been taped or wrapped in plastic to minimise damage and contamination with the uncured compound mix.

4.1.2 Mixing

The materials for Wet Pour surfacing are mixed on site in a controlled environment. The mixing process is such that only specially manufactured mechanical mixers of planetary mixing motions will achieve the correct consistency of mixed material. Conventional 'cement' type mixers are not suitable for this purpose. Critical aspects of the mixing process are the time taken to satisfactorily mix an individual batch and the time taken to place the material in final position following initial addition of the binder.

4.1.3 Placing

The mixed material is normally transported from mixer to final location by dumper or barrow and placed on the prepared base by shovel, rake and/or screed. Speed of operation is of the essence due to the fact that the material will be gradually curing and will become difficult to work in a period, which will vary depending on the ambient weather conditions, but may be as little as fifteen minutes after mixing.

The finished level is achieved by trowelling off the polymeric mixture and compacting by a combination of hand trowelling and/or rolling with a smooth wheeled roller. On completion, the finished surface should be inspected to ensure that no roller or float marks are evident.

4.1.4 Impact Layer

Using screeds, hand-trowels, tampers, rollers and level guide, install rubber impact layer at a consistent density - this will be achieved by manual compaction using the tampers and rollers. The appropriate level guides will ensure that the required thickness is obtained to ensure compliance to Standards for the fall heights needed of the installed playground equipment.

4.1.5 Top Layer [Wearing Course]

Using hand trowels, level guides, tampers, rollers and steel floats, install the top layer to the required density by manually compacting to a thickness not less than 15 mm.

The material is to be floated to the level guide ensuring uniform thicknesses, and it is imperative that the surface is compacted sufficiently [by tamper or roller] so that the rubber granules are suitably bound throughout the complete matrix profile.

Allow the top layer to cure [minimum overnight] prior to allowing any foot traffic on the surface. This curing period may extend subject to the type of polyurethane being used and climatic conditions being experienced at the site at the time of installation.

4.1.6 Construction [Key] Joints

It is important to ensure that construction joints or overnight joints are kept to a minimum within each individual area of IAS.

Construction joints are, however, a necessary part of the installation process and may be required due to the overall dimensions of the area, weather problems, etc. All joints should be constructed in a straight or curved line which must be regular in appearance.

Compaction must be ensured at any joints and around equipment legs, edging kerbs, etc. To aid adhesion, it is advisable to prime edgings with a diluted binder solution prior to placing the surfacing.

4.1.7 Jointing for Dual Layer Surfaces [All] and Single Layer Surfaces on Quarry Material

All joints between pours of the top layer or colour changes or design shapes of the top layer should be of KEY or Z shape. The vertical face of the joint should be no less than half the thickness of the top layer surface [approx. 7.5 mm], while the horizontal plane of the joint should extend 150 mm and should taper to feather thin height at the out extremity of the joint. When these joints are cured and the next colour of pour is taking place, the key joint vertical and horizontal planes should be wet primed with a light coating of polyurethane/solvent mix. This should be installed at a rate just ahead of the Wet Pour laying so this remains wet and tacky at all times. If cured off, lightly buff and reapply before installing new surface.

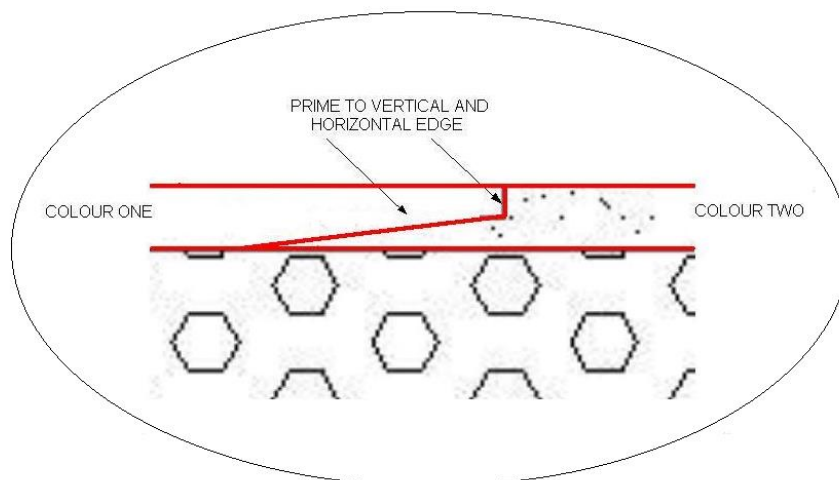
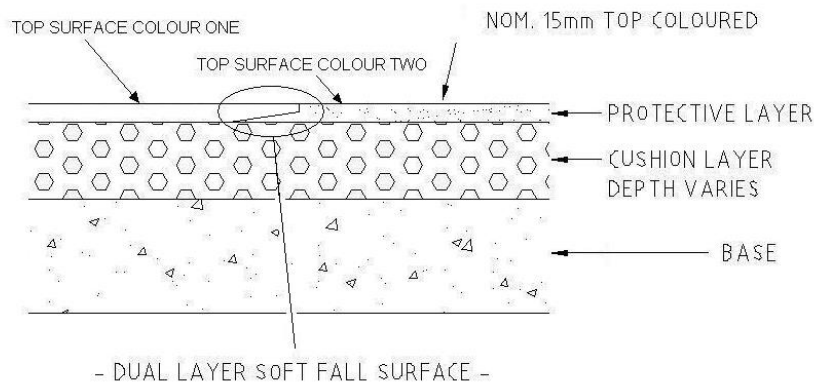


Figure 5: Key Joint Detail

4.1.8 Jointing for Single Layer Surfaces on Structural Base

On hardstand base layers and when a single IAS layer is being used, vertical butt joints are acceptable but again the vertical face needs to be wet primed at time of abutting pour.

4.1.9 Quality of Finished Installation

The finished installed Wet Pour rubber surface shall comply in all respects with any reference sample submitted to the client and be within the following limits:

- Colour should be uniform at the time of installation, though it should be noted that with certain colours this can be difficult to achieve, especially with Site Mix Pigmented systems. All other system types are batched colour systems so care is required to monitor batches as there will be tonal differences.
- The binders which are universally used are based on single pack moisture curing MDI-type isocyanates. These chemicals go yellow/brown on exposure to light. The chemistry is similar to the 'browning' of peeled apples. The rate of colour change depends directly on UV levels and humidity during the curing period. There is no evidence to show that this phenomenon causes any deterioration of the physical characteristics of the wearing surface. It is common for the original granule colour to be gradually restored due to wear on the surface binder. Over the passage of time the effects of UV, natural ageing, weathering, light and shade etc. will have an effect on the colours of granules used in IAS.
- The composition of the material installed on site shall match that of any reference samples submitted in respect of physical characteristics, i.e. thickness, density, homogeneity, weight per unit area, particle shape and size etc.
- The tensile strength of the wearing layer of any reference sample and the material installed on site shall be greater than 4 MPa. The tensile strength of the supporting layer of any reference sample and the material installed on site shall be greater than 0.15 MPa.
- The elongation at break of the wearing layer of any reference sample and the material installed on site shall be nowhere less than 75%. The elongation at break of the supporting layer of any reference sample and the material installed on site shall be nowhere less than 25 %.

4.1.10 Surface Levels (at the time of installation)

Where it is intended for the Wet Pour rubber surface to be laid either flat or to a uniform fall, any localised bumps or hollows shall be such that when a 3 metre long straight edge is placed in any position on the surface, the gap between the straight edge and the surface shall at no point be greater than 6 mm, nor greater than 3 mm when a 300 mm straight-edge is placed in any position on the surface. The finished IAS shall finish flush with the top of the surrounding concrete edging kerb and provide no tripping hazard. Steps in excess of 3 mm between the synthetic surfacing and the surrounding area (i.e. at edges of synthetic surfacing) are not acceptable. Additionally, there shall be no ridge, groove, crease or change in surface texture anywhere on the area such that would be deemed to cause a trip hazard to users (with the exception of cases covered in Section 3.3).

4.1.11 Jointing

The method of jointing shall be such that no ridge, groove, crease, or change in surface texture shall be apparent along any joint to the extent that it may cause a potential hazard to users. Cracking, splitting or separation of joints formed within in-situ surfaces is not acceptable. On completion, joints within in-situ surfaces are to be flush with no step or ridge.

4.1.12 Quality of Surface

The installed surfacing is to match the quality of any reference sample submitted with the tender and, if tested to the methods described in AS 4422:2016 Impact absorbing playground surfacing - Performance requirements and test methods, the surfacing shall satisfy the performance requirements of AS4422:2016 and AS4685.0.2017.

4.1.13 Surface Cracks

Surface cracking will occur in wet pour rubber surfaces in exactly the same way and for the same reasons that they occur in concrete slabs, plaster screeds and bitumen surfaces. These are often beyond the control of the applicators even when using best practices

Wind conditions, high diurnal range and high humidity, even when in the range specified for normal application, can cause surface cracking. If the cracking is minor and is only a surface crack, then this can be deemed as acceptable. If the crack is completely through the Top Layer then repair will be necessary.

4.2 Installation Methods: Artificial Grass

Artificial grass surfaces can only be laid in certain weather conditions. This is because the types of adhesives used to join the rolls of carpet may not fully bond if laid in very cold or wet conditions and the carpet and sand infill need to be dry to allow the sand to flow into the pile of the carpet. Surfaces should only be laid when conditions satisfy those stipulated by the adhesive and carpet manufacturers. This is very much a case of the experienced contractor knowing best and they should not be pressurised to lay a surface in less-than-ideal conditions just to complete the work on time.

4.2.1 Carpet installation

Prior to laying out the artificial grass carpet, the base should be swept to ensure there are no loose stones or other debris lying on it. The artificial grass carpet should then be rolled out in the configuration shown on the seaming plan and the rolls checked for any signs of damage or defects.

Following the checking of the roll, the edges should be overlapped by an amount sufficient to allow trimming and the edges then trimmed to produce a good butt joint. After trimming, the gap between the edges should be no more than the distance between each tuft row.

The carpet should then be turned back from the trimmed joint and a carrier tape positioned on the joint line. The tape should be positioned centrally to give a bond width in accordance with the manufacturer's instructions. A water-based "tacky" adhesive may be used under the tape to prevent movement.

4.2.2 Sand application (where applicable)

The surface will not perform optimally and its durability will be compromised if the carpet is not correctly sanded prior to play. This part of the installation is therefore crucial. Before infilling, it is recommended that the entire surface is brushed to aid the turf fibre to stand upright.

The sand should be applied evenly in stages ensuring that the sand is brushed into the pile in such a way that the pile remains upright. Extreme care and attention should be taken when applying the sand. The dressing must be finished to a constant depth within the base of the pile.

If using a wheeled vehicle to transport sand across the surface, make sure that the tyres are smooth – tyres with treads such as herringbone tyres will permanently mark the playing surface. The recommended ground pressure of tyre to turf surface is between 8 and 11 pounds per square inch. Drive with care over previously sanded areas and do not make sharp turns or stop suddenly.

It may be necessary to return to site to top up sand levels after installation. The amount needed for top dressing can only be determined on an individual basis.

4.3 Installation Methods: Loose Fill Materials

Loose fill materials should be installed to a depth of 300mm and not allowed to drop below 200mm. PPE should be worn at all times while installing loose fill materials.

5 Section Five: Maintenance

5.1 Maintenance: Wet Pour Rubber, Unitary Products, Multi-Layer Unitary Systems

There is no such thing as a maintenance-free surface, and all safety surface installations will require some degree of routine maintenance throughout their life. The installer should be consulted on their specific maintenance recommendations as neglecting the recommended maintenance regimen may invalidate any warranty and diminish considerably the life span of the surface.

Every client should be given a maintenance document along with their impact certificates and warranty certificates when the project is handed over. The maintenance document should note that if certain aspects of the surface are not maintained as per this document then Warranties may become void.

Well maintained surfaces should have a compliant lifespan of 7-10 years under normal circumstances subject to level of usage, degree of maintenance carried out, location and climatic conditions.

5.1.1 Moss and Algae

In certain situations, moss and algae may grow on the surface. This is usually when the surface has not been kept clean and dirt and other deleterious material has been allowed to build up in the matrix of the rubber layer. Coupled with shady locations and poor drainage or wet conditions, this will allow moss and algae to grow. The best method of eradication is to pressure wash surface and then treat with a solution of 2% copper sulphate in water, or standard mild bleaches or chlorine can also be used.

Moss is not usually found on the parts of the surface that are trafficked by play, and although it may not be essential to treat these areas it is still a wise precaution to do so. However, particular attention should be paid to perimeter and other areas that are not trafficked, especially if they are shaded by walls or buildings or are overhung by trees or are under equipment. Any good proprietary product should be satisfactory, provided that it is not oil-based, however, the manufacturer's instructions should be closely followed. Some installers can supply specially formulated moss-killers.

Where moss becomes established it should be treated immediately, the application being repeated after the dead spores are removed until eradication is complete. The dead moss may be removed by using pressure water jetting apparatus, but care must be taken to ensure that excessive pressure is avoided as this can permanently damage the surface.

It should be emphasised that moss is only a serious problem if it is allowed to become established. An annual prophylactic application of moss-killer is an easy way of preventing this problem.

5.1.2 Cleanliness

The surface will become contaminated with dirt from children's shoes, sand from sandpits, windblown dust and various contaminants such as chewing gum, soft drinks etc. The most effective method of cleaning is by use of blower, outdoor vacuum and water-jetting apparatus, though chewing gum is best dealt with using a freezing spray in order to embrittle the gum and make it easier to remove.

If the surface is not cleaned regularly then the following could occur:

- Slip resistance will be impaired and the surface could become hazardous.
- The surface may become hard due to infiltration of dirt/sand etc. This will diminish elongation and the surface impact performance requirements as per AS4422 may become non-compliant.
- Dirt and sand will act as an abrasive, causing the surface to wear more quickly and abrasion of surface colour coating to accelerate.

5.1.3 Weeds

No matter how much care is taken, weeds may occasionally appear on the surface, usually as a result of wind-blown seeds. Small numbers of weeds can be removed by hand without damaging the surface. If the weeds are removed by hand, it is important to ensure that the full root of the weed is extracted, not

broken off. Some weeds become more prolific if they are simply cut off at surface level. If the weeds are deep-rooted it is advisable to kill them off with an appropriate weed-killer. Localised areas of weed seedling infestation can be treated with domestic weed-killers without causing damage to the surface. Oil-based weed-killers should not be used.

5.1.4 Snow and Ice

Snow and ice are not harmful and can be permitted to melt through. Metal shovels or scrapers may damage the surface and should not be permitted. Rock salt should not be used. In certain cases, vacuum-dried salt or urea have been used as effective preventatives, when applied in advance of the weather deteriorating.

If the play area is used when the surface is in a frozen state, the degree of shock absorption will also be substantially reduced and clients should be made aware of this fact.

5.2 Maintenance: Artificial Grass

The above notes with reference to wet pour rubber apply to other surfacing systems. Artificial grass maintenance procedures also include:

- Sweeping and/or blowing leaves and other detritus from the surface: Leaves, tree flowers, pine needles and other detritus should not be allowed to remain on the surface for any length of time. If this does happen, they rapidly rot down forming a drainage-inhibiting "skin" within the surface, and providing a growing medium for algae and moss. A wide soft broom or a rubber-tined rake is ideal for removing vegetable matter and other rubbish. Better still, a mechanical leaf-sweeper or garden vacuum cleaner/blower will greatly speed up the operation. The equipment should be well maintained and carefully operated to avoid contamination of, or physical damage to, the surface. Both sweepers and vacuum cleaners/blowers may tend to remove rather too much sand during the first few months of the life of the surface, but thereafter this should cease to be a problem. Some disturbance of the surface of the sand may be a positive benefit,
- Brooming the surface to freshen the fibre surface, counteracting any slight sand drift or compaction and counteracting any tendency to form an impervious skin on the sand surface that might impair drainage. Brooming the surface is a crucial operation if premature loss of appearance and drainage is to be prevented. Apart from freshening the look of the surface (rather like a lawn mower striping a lawn), the purpose of regular and fairly vigorous brooming is to prevent the formation of a compacted and impervious skin on the top of the sand layer, which will inhibit drainage and encourage moss and algae. A three-foot wide (91.44cm) broom with bristles of medium stiffness is best; the installer should be able to recommend or supply the correct type. It can be dragged over the surface or, better still, pushed. Brooming should ideally be done in both directions: in the length of the court and then at right angles across it, but if this is too time-consuming, the direction of brooming can be varied from time to time. If, in spite of the regular brushing described above, or as a result of a lack of it, the sand-filled surface becomes over-compacted and impervious, this condition can often be corrected by appropriate treatment, usually involving the use of specialist machinery. Machines vary from simple scarifiers to more elaborate proprietary machines which remove a proportion of the sand from the carpet and replace it with new sand. The best of these processes will prolong the useful life of the carpet by several years.
- Applying prophylactic treatments of moss-killer and/or algacide. In certain situations, and in some seasons, algae or moss can become established on the artificial grass surface. Moss is not usually found on the part of the surface which is trafficked by use, and although it may not be essential to treat these areas, it is still a wise precaution to do so. Particular attention should, however, be paid to those perimeter and other areas that are not trafficked, especially if they are shaded by walls or buildings or are overhung by trees. Any good proprietary product should be satisfactory, if it is not oil-based. The manufacturer's instructions should be closely followed. Some installers can supply specially

formulated moss-killers. As soon as signs of moss are found it should be treated immediately, the application being repeated until the moss can be brushed and cleared away. In the case of very severe infestation, the installer should be consulted. High pressure cleaning equipment is now available but its use is a skilled process. It should be emphasised that moss is only a serious problem if it can become established. Regular brooming and use of the playground renders moss an even less likely problem.

The installer's guarantee will usually be conditional on the recommended maintenance requirements being carried out with reasonable diligence.



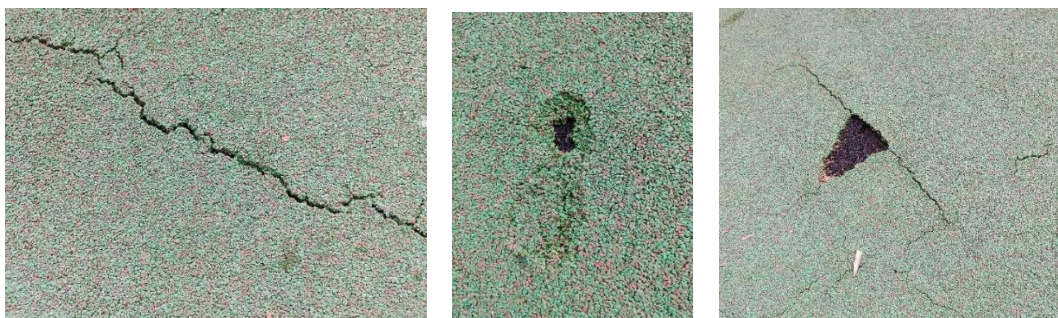
Commercially available three foot broom suitable for use on artificial grass maintenance

6 Section Six: End of Life

6.1 End of Life: Wet Pour Rubber, Unitary Products and Multi-layer Unitary Systems

Wet pour rubber surfaces may reach their life expectancy due to age, wear and tear, vandalism or incorrect installation procedures. It is important to replace the surface before it breaks up and causes microplastics to be released into the environment.

Loose rubber material is microplastic; therefore, the surface needs to be repaired before it breaks up. If the surface is beyond repair, it should be removed before the point at which the surface breaks up, thereby preventing the microplastic from reaching drains and therefore the ocean. Below is a recommended replacement lifespan for the product. This estimate is designed to take into account the usage and age of the material, i.e. if the wet pour rubber surface is heavily used in a regional playground, it needs to be replaced sooner due to the number of users on the surface. If the playground is near the water or coastline, this may need to be monitored and if necessary replaced sooner. If the playground is in a local park in country NSW, then the life expectancy should be longer and the risk to the ocean environment is lower.



Cracking of and damage to a wet pour rubber surface

The following table gives an estimate of the expected life of different Impact Attenuating Systems in Australian conditions:

		Estimated Life of Playground Surfacing		
		By Years		
		Local	District	Regional
Man made	Artificial Grass 40mm	10	8	5
	SBR	10	8	5
	Coated SBR	10	8	5
	EPDM	15	12	10
	TPV	15	12	10
Organic	Bark Mulch	2	1	0.5

6.2 End of Life: Artificial Grass

When removing the artificial grass surface at the end of its usable life, it is important that the material is correctly handled to prevent any of the component parts from contaminating the environment. At the end of its life ALL the parts of the artificial grass being removed is considered waste. Therefore, the materials must be removed, disposed or recycled in accordance with waste regulations. During the removal of the artificial turf playing surface at the end of its usable life, it is important that the material is correctly handled to prevent any of the component parts ending up contaminating the environment. At the end of its life ALL the component parts of the artificial grass being removed is considered waste and therefore the removal, disposal or recycling of the materials needs to be done in accordance with waste regulations.

It should be ensured that the contractor appointed to remove the artificial surface is licensed and able to demonstrate a full chain of custody for the materials from the point they leave the field to being recycled, reused or disposed of. The removal and transportation of an artificial grass surface and its infill should be undertaken in a way that will minimise infill migration using the principles noted within this Code of Practice with consideration given to the following:

- The use of mechanised methods using purpose-built equipment to remove the infill within the confines of the existing pitch.
- Use of secure storage for the removed infill material.
- Use of containers or close sided vehicles to prevent infill migration during transport.
- Ensure that all working areas are thoroughly cleaned on completion of the process.

All contractors must wear PPE during the removal process.

7 Section Seven: Warranty

7.1 General

The installing company should provide a warranty for at least a three year period after installation to cover the client for faulty workmanship and/or materials used in the installation of the surface.

7.2 Conditions of Warranty

Any warranty given will exclude defects which arise from:

- Incorrect or inadequate maintenance
- Defects in the underlying surface or foundations (where this did not form part of the installation contract)
- Adverse ground conditions
- Misuse and vandalism
- Fair wear and tear

The defect should be reported to the installing company promptly and the company must be allowed access to examine and assess the defect.

Please note: *The installing Company will pass a copy of the warranty to the client on completion and handover of the works.*

8 Section Eight: Limitation of the Surface System

8.1 Infill Migration Mitigation

This section outlines methods to contain the infill materials used in playground constructions, within the confines of the surface, preventing them being dispersed into the surrounding environment during use. The options described are based on examples of best practice taken from industry experts in sports facility construction. This practical guidance can be used by both designers and installation companies undertaking this kind of development.

The options outlined in this section range from changes to system designs through the use of innovation in product design, to simple barriers to prevent infill migration and by the inclusion of good facility management processes and better facility designs.

8.1.1 System design: Wet pour rubber, unitary products, multi-layer united systems

Playground surfaces consisting of wet pour rubber laid directly onto a base could potentially result in infill migration of loose rubber. The principal causes include:

- Cracking and damage to the wet pour rubber surface could create loose rubber.
- Installation of rubber surfaces causes loose rubber to be spread into the area around playgrounds.
- Spillage of rubber during installation from poor construction methods.
- Poor storage containment of bags of rubber during construction.
- Lack of proper clean up of site at conclusion of installation.

During the construction of the playground surface, the handling of loose rubber in its transportation, storage on site, installation and site clearance on completion of the project is key to preventing contamination of the surrounding environment. Playground installers should ensure that working practices minimise loose rubber loss from the confined working area with care taken to provide designated storage areas with close proximity to the actual playground surface. Consideration should be given to the following on-site working practices where applicable:

- Storage of palletised bags in a designated area to ensure the loose rubber can be contained during the installation process, spillages retained within the area and removed on completion of the project.
- Handling of the loose rubber material during loading of machines and installation to be confined to the area which is protected from spills.
- Care and attention given during the operation of machinery to ensure that the infill remains within the confines of the surface area. Note that this can be achieved by protecting the area with plastic sheets.
- Where possible, ensure that the installation of infill is carried out in optimum dry conditions.
- Regular cleaning of installation equipment to prevent infill leaving the working area.
- Any loose rubber in surrounding areas needs to be vacuumed and removed from site.

8.1.2 System design: Artificial grass, loose fill

Playground surfaces consisting of artificial grass laid directly onto a base are often considered to have a greater propensity for the infill to be mobile due to the higher content of rubber infill and the open nature of the carpet pile, and therefore there is a higher chance that it could migrate into the environment. To combat this situation, and to minimise infill loss, manufacturers have designed different systems such as:

- 60mm pile height carpets which incorporate a thatch zone comprising curly tufts to stabilise the infill.

- Shorter pile carpets (40mm) with increased tuft densities which include the use of shockpads to give additional performance to the system. These systems incorporate a much lower quantity of polymeric infill which leads to a lower level of infill migration.
- Products comprising curly or texturised yarns.
- Use of organic infills, thus ensuring that the infill material is not polymeric and therefore not considered a microplastic. These systems require the use of shockpads to achieve the required sports performance requirements.
- Use of different shaped polymeric infill. Rounded granulate can assist the drainage capacity of the surface but angular infill material can lock together better to provide a more stable infill.
- Both FIFA and World Rugby have a test in their performance standards for Infill Splash, which promotes the use of products with a lower splash value and hence more stable infill and lower dispersion of infill from the carpet.

There are a number of situations during the usage of a 3G artificial grass surface which can cause the infill to migrate from the grass into the surrounding environment. These situations need to be considered and addressed by pitch designers, installers, maintenance companies and users. The principal causes are:

- Children and adults carrying the material from the surface on footwear and clothing.
- Maintenance operatives and machinery carrying the material from the grass.
- Inappropriate or lack of maintenance procedures being used.
- Poor storage containment of infill material.
- Surface water run off or surface flooding.
- Wind dispersion.
- Snow removal.

During the construction of an artificial grass surface, the handling of infill in its transportation, storage on site, installation, and site clearance on completion of the project is key to prevent contamination of the surrounding environment. Installers should ensure that working practices minimise infill loss from the confined working area with care taken to provide designated storage areas with close proximity to the actual artificial grass area. Consideration should be given to the following on-site working practices where applicable:

- Storage of palletised bags in a designated area to ensure the infill can be contained during the installation process, spillages retained within the area and removed on completion of the project.
- Handling of the infill material during loading of machines and installation to be confined to the area within the pitch boundaries where applicable.
- Care and attention given during the operation of machinery to ensure that the infill remains within the confines of the surface area.
- Where possible, ensure that the installation of infill is carried out in optimum dry conditions.
- Regular cleaning of installation equipment to prevent infill leaving the working area.

8.1.3 Facility design features: Artificial grass, loose fill

There are a series of potential design features that can be incorporated into artificial grass surfaces to minimise infill being lost from the surface during use. Some of these are actual physical barriers, some are improved access control for users and other have more subtle approaches which can be incorporated into the design of the playground.

The suggested designs outlined in this section will not all be applicable to all locations. A playground in a community setting with no external run offs, would require a more substantial physical barrier around the perimeter of the area.

Surface Profile

Playgrounds are often designed with gradient of up to 1% to aid the removal of surface water from the surface. Whilst it is important that the site drains sufficiently, the greater the slope, the more chance that infill can be carried to the lower perimeter of the area. Constructing a surface with a gradient no greater than 0.5% can prevent the movement of infill in this way.

Surface Drainage

Surface drains on the site should contain silt traps to prevent infill washed into the drain entering the storm water drainage system.

Perimeter detail

To minimise the loss of infill from the perimeter of the site during both play and maintenance, consideration should be given to the inclusion of additional hard standing (asphalt or paved areas) around the external perimeter of the site. These areas would normally be a minimum of 0.5m wide or larger if designed with spectator areas. An additional design to minimise infill loss would be to also include 200mm high kick boards on the perimeter fencing comprising timber or recycled material.

Containment barriers

The installation of physical barriers around the perimeter will provide the best form of protection to minimise infill loss through use of the pitch or during maintenance work. Where the synthetic surfacing is laid up to the perimeter fencing then barriers of 500mm high are recommended to prevent infill being lifted and deposited into the surrounding environment. Where additional hard standing run offs are incorporated or spectator areas then 200mm timber boards or raised perimeter edgings are considered suitable.

Field entrance points and boot cleaning stations

All entrance points should incorporate a combination of decontamination grates and scraper mats which are the full width of the entrance point to ensure that all infill is collected. The grates should be recessed to collect infill and have suitable drainage and silt traps to allow water to pass away whilst still collecting the infill.

Multi-person shoe cleaning stations with suitable signage should also be positioned at the main points of access from the playground. If mounted outside the playground, it should be positioned on a recessed paved area that is designed to retain the dislodged infill and has a drain filled with a silt trap to prevent any infill being carried by rainwater runoff.

8.2 Shade

AS4685.0:2017 Playground equipment and surfacing, Part 0: Development, installation, inspection, maintenance and operation (Appendix A) provides the following guidance:

There is a risk that the playing child is overexposed to the ultraviolet radiation of the sun. Too much UV radiation and sunburns in childhood increase the risk of developing skin cancer later in life. Therefore, the playgrounds should be organised in a way that takes into account the availability of shade options, and that a part of the playground equipment and recreational areas are placed entirely or partly in shade.

Australia has the highest rate of skin cancer in the world. Most forms of shade can reduce UV exposure by up to 75%. When used in conjunction with other protective measures, such as sun-protective clothing, hats, sunglasses and sunscreen, shade is the best way to provide maximum protection against UV radiation. Factors to be considered when selecting an appropriate means of sun protection and shade for playgrounds include the following:

- UV radiation: The amount of ultraviolet radiation and heat likely in the area (UV radiation will vary according to location, climate, season and time of day).

- Built shade: This can be stand-alone or it can be built onto existing buildings or structures. All built shade consists of two parts: the supporting structure that keeps the shade structure in place and the primary shading element. NOTE: Certification may be required from a qualified structural engineer to ensure structural integrity and safety.
- Natural shade: Use of natural shade from trees is an essential part of shade planning, as it is one of the most effective and attractive ways of providing shade. The effectiveness of natural shade depends on the density of the foliage and the size of the canopy. As a general rule, trees with a canopy that is dense and closer to the ground provide the best protection from direct UV radiation.
- Existing shade: Plans should be made to optimize the use of existing shade. For example, play equipment could be moved to a shaded area, or low branches could be removed from trees to allow children to play underneath.
- Site usage patterns: Consider the usage patterns at the site, particularly the time of day and time of year it is most in use, and maximize shade at peak use times. Shade can be provided by trees and canopies (natural or built); shadows from buildings nearby; and areas underneath platforms. Consider performing a shade audit to document shade at different times of the day.
- Climatic conditions: Consider the characteristics of the climate zone as well as any local weather conditions. These factors will affect the design of a shade structure as well as the selection of tree species.
- Seasonal conditions: Ensure shade does not make an area uncomfortable and cold in winter. A shade structure may also provide rain protection for children. Summer shade provision should minimize UV radiation levels as well as reduce heat and light. Winter shade provision should minimize UV radiation levels, while allowing for transmission of sufficient levels of heat and light. Care needs to be taken that providing shade in summer does not create other problems (such as the introduction of slipping hazards where moss might propagate, or dark cold areas in winter). A playground in the north of Australia may also require a larger and more permanent canopy because of the higher temperatures over a greater proportion of the year than would one in Tasmania. UV levels in Tasmania, on the other hand, may be higher.
- Indirect UV radiation: Materials used for playground equipment, shade structures and surfacing can all attract indirect UV radiation. Consider the best materials to use for individual locations. Shade can provide protection by putting a physical barrier between sunlight and playground users. The degree of protection provided by shade is determined by the effectiveness of different materials, its placement, and its height above the ground. Research has confirmed that harmful levels of UV exposure can occur from reflected UV radiation. Consideration should be given to exposure to reflected UV radiation from playground surfacing outside the shade canopy. Care should be taken with site equipment so that it is correctly positioned with respect to sun exposure. Poorly shaded platforms and playground surfacing materials (such as rubber surfaces) can become unacceptably hot if exposed to too much direct sunlight. Large flat or inclined surfaces, especially metal ones, likely to be contacted by the user (e.g. on a slide) may heat up and cause serious burns. Protecting the impact-attenuating surface and the slide from direct sunlight by the use of trees or shade cloth are examples of ways in which this hazard may be reduced.
- Ground surfaces: Barefoot play on unshaded ground surfaces, including unitary safety surfaces, may expose children to burns on very warm and hot days. Playground operators, in particular SECS, shall assess burn hazards on such days and take appropriate countermeasures.
- Safety: It is important to ensure that shade structures do not create safety hazards by allowing users to climb onto the shade cover. The lowest accessible edge of the shade cover should provide a minimum clearance height of 2.5 m from any part of the play structure to prevent access by climbing.



Shade structure manufactured and installed by NT Shade, Playgrounds & Rubber

8.3 Contaminants

The following products may cause damage to the surface and should be avoided: strong disinfectants, concentrated chlorine bleaches, petrol, diesel, hydraulic and lubricating oils and organic solvents.

8.4 Fungal/Bacterial Growth

Fungal and bacterial growth cannot occur on wet pour rubber or polyurethane of the composite mix. Rather, when regular maintenance is not carried out, dirt and organic material builds up in the open pores of the matrix. When this situation occurs and the surface is in a shady and/or damp location, then bacterial growth can occur on this deleterious material. This is not a product failure but a result of lack of maintenance. It can be easily rectified by power washing and using a solution of 1% copper sulphate in water or by applying most mild bleaching agents.

8.5 Tonal Changes

Due to the nature of wet pour Site Mix Colour system, tonal changes can occur from time to time. This can be caused by differing dust levels in raw materials, changes in relative humidity or UV changes during the course of the application day. This should not be considered a fault of the product. Most tonal differences will dissipate to a more even colour over the course of time. All Precoated SBR, EPDM, TPV and Thermal Plastic granules are manufactured items and like most building materials will be subject to slight tonal changes between batches.

8.6 Yellowing

Yellowing of the wet pour rubber's top surface is sometimes noticeable when using standard aromatic polyurethane binders. The yellow-coloured polyurethane will react with the UV rays and can affect light blue, light grey and some other colours, changing their visual appearance. This is only the very minor top skim coat and as the surface comes under constant foot traffic and is under constant UV, the exposed polyurethane skin will dissipate in the majority and the original colour will become evident. An Aliphatic binder can be used to inhibit the yellowing occurring and is readily available, although at a much higher cost.

8.7 Fading

Irrespective of material content, level of UV inhibitors or quality of the EPDM, TPV or Thermal Plastic granules some of the bright organic pigmented wet pour rubber colours are not stable under Australia's UV levels. Bright Red, Bright Yellow, Orange, Purple and some others will fade dramatically over time. All other colours are subject to only minor tonal fading.

9 Section 9: Bibliography

- AS 4685 Parts 0-7 (2008) Playground Equipment and Surfacing
- AS 4422:20 22 Impact Absorbing Surfacing; Safety requirements and test methods
- ISO 37 (2005) Determination of tensile stress-strain properties
- AS1530 Methods for fire tests on building materials, components and structures Simultaneous determination of ignitability, flame propagation, heat release and smoke release.
- National Playing Fields Association*. Impact Absorbing Surfaces for Children's Playgrounds ISBN 094608535 (*now called 'Fields in Trust')
- Absorbing Surfaces for Children's Playgrounds. ISBN 094608535
- API Guide to the provision of rubber and loose fill impact absorbing surfaces (1997)
- Disability Discrimination Act
- Code of Practice: right of access: goods, facilities, services and premises. ISBN 0117624322
- National Playing Fields Association*. Legislation and Children's Play (1997)
- AS 2150-2005 Hot Mix Asphalt-A Guide To Good Practice
- SA TR CEN 17519:2021 Surfaces for sports areas – Synthetic turf sports facilities – Guidance on how to minimize infill dispersion into the environment.

10 Appendix A – Test Methods

This section briefly outlines each test method. For further information and the latest requirements and methodologies, please refer to the appropriate Australian Standard.

10.1 Critical Fall Height AS 4422

In this test, a Spherical head Form of mass 4.6 kg is dropped from progressively greater heights onto the sample. The Head Injury Criterion (HIC) of each impact is calculated from the acceleration/time record of the impact, using the formula:

$$\text{H.I.C.} = \left[\left\{ \frac{\int_{t_1}^{t_2} a \cdot dt}{(t_2 - t_1)} \right\}^{2.5} \times (t_2 - t_1) \right]_{\text{max.}}$$

Equation 1: Head Impact Criteria

The Critical Height is determined by producing a 'best fit' curve for the various HIC values against drop height and interpolating to obtain the drop height corresponding to an HIC of 1000. For in-situ formed surfaces, the test is carried out in at least four positions. Those positions are equidistant each other and the edges of the tile. The Critical Height is determined by producing a 'best fit' curve for the various HIC values against drop height and interpolating to obtain the drop height corresponding to an HIC of 1000.

Field Testing AS4422:20 22 and AS4685.0

A minimum of one test shall be carried out per 10m² of impact area. One drop shall be performed for each location based upon Hm [FHOFF plus 10%] of the respective item and in accordance with the location and number of test points required for individual types of equipment as detailed in AS4422 Table 2.1. If the CFH of the surface is greater than the Hm [FHOFF plus 10%] only one drop is required.

10.2 Durability AS.2001.2.28

This test utilises the Taber Abrader apparatus fitted with Type H18 wheels operating under a load of 1000g. The results reported are the Wear Index, which is the greatest of the incremental weight losses recorded during the course of the test and the Wear Ratio, which is the ratio of the first weight loss recorded to that of the fifth weight loss recorded.

To assess the environmental resistance of the product under test, the durability test is carried out on a specimen in the as-received condition and repeated on further specimens after ageing for 14 days at 70°C in air and in water respectively and after UV ageing to four times Blue Wool Scale or tested to the ISO 105-B02 Textiles — Tests for colour fastness — Part B02.

10.3 Slip Resistance AS4586

This is measured using the Transport and Road Research Laboratory Portable Skid Resistance Tester. The test is repeated on the surface under wet and dry conditions and in two directions at 90° to each other.

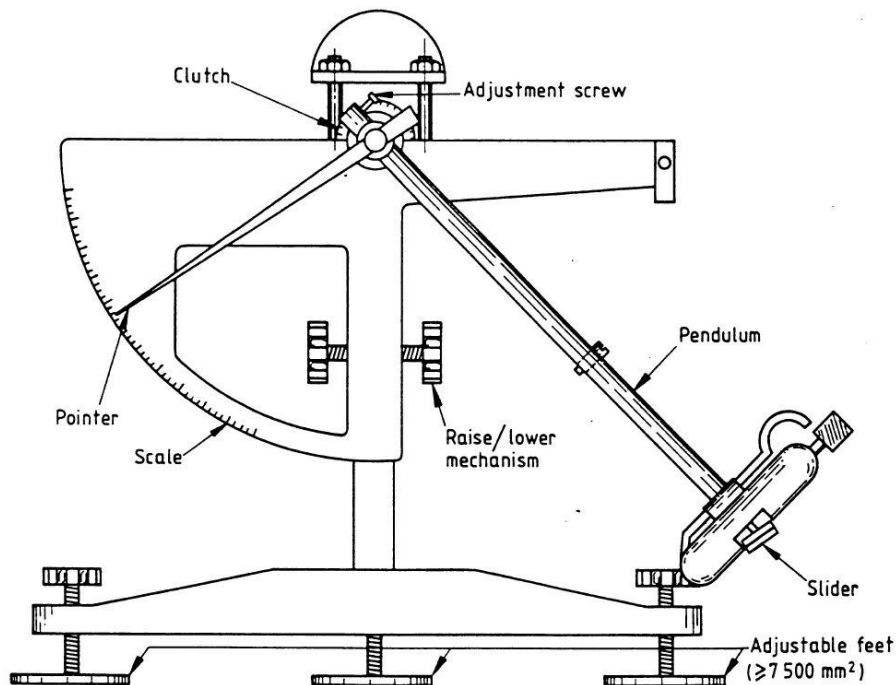


Figure 6: Apparatus for Slip Resistance (TRRL Skid Resistance Tester) after AS 4685 Slip resistance and pedestrian surfaces. HB198 2014 Slip Resistance for pedestrian surfaces

10.4 Indentation Resistance AS 4693.1

This is determined by allowing a circular indenter, with an area of 100 mm², to rest on the surface of the sample under a superimposed load of 500 N.

The depth of penetration of the indenter into the surface is measured after 90 seconds and 15 minutes. The load is then removed, and the recovery of the surface measured at the same intervals and also after 150 and 1500 minutes.

10.5 Flammability AS1530.4

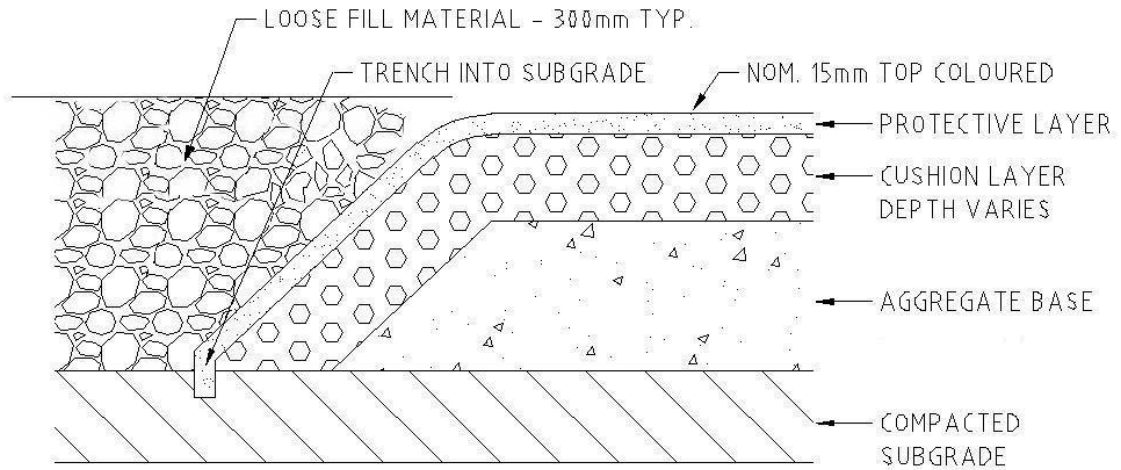
This is assessed by the method of AS1530 Part 4 Combustibility test for materials to the BCA standard. The surface shall have a 'low' radius of effects of ignition.

The 'Hot Metal Nut test' was the old test to BS7188. In this test a nut of defined size and mass and at a temperature of 900°C is placed on the surface. The area affected is measured and the results classified as 'Low', 'Medium' or 'High' radius of effects of ignition.

10.6 Tensile Strength and Elongation at Break AS.4693

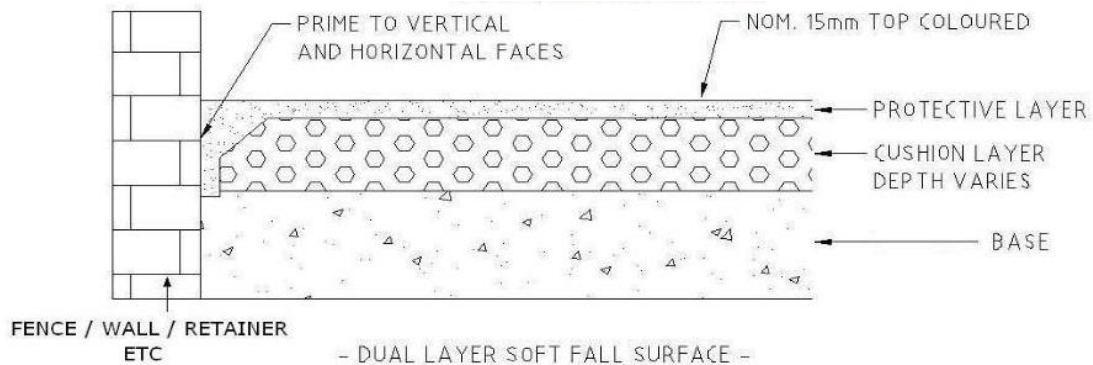
The Tensile Strength and Elongation at Break were determined in accordance with AS.4693) at a jaw separation speed of 100 mm/min using a 25 mm wide dumb-bell.

11 Appendix B - Typical Wet Pour Surfacing Details

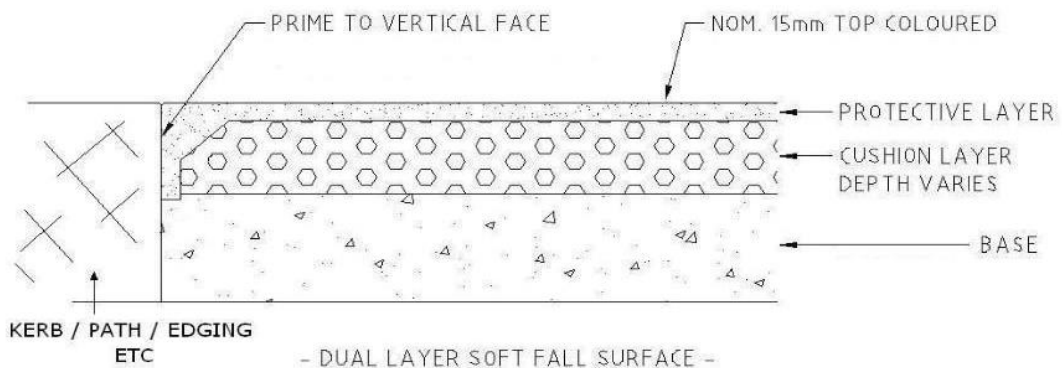


- DUAL LAYER SOFT FALL SURFACE -
TYPICAL EDGE DETAIL FOR "LOOSE FILL"

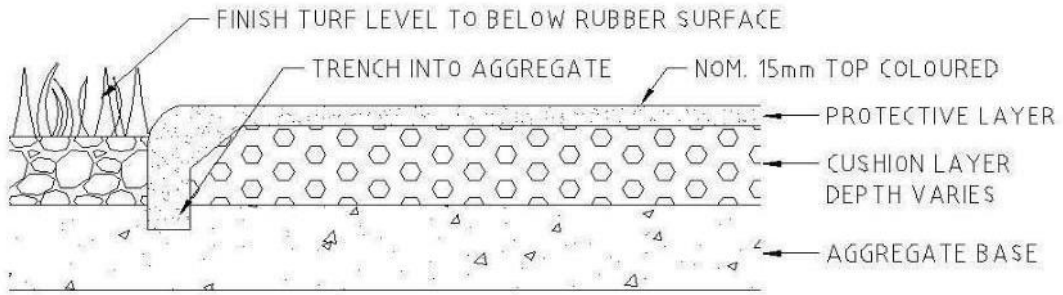
Type 1: Battered edge to loose fill



Type 2: Thickened edge to hard vertical

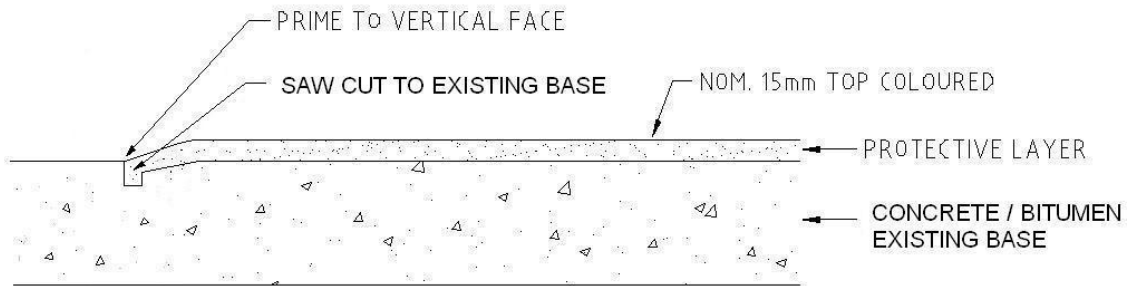


Type 3: Thickened edge to hard level



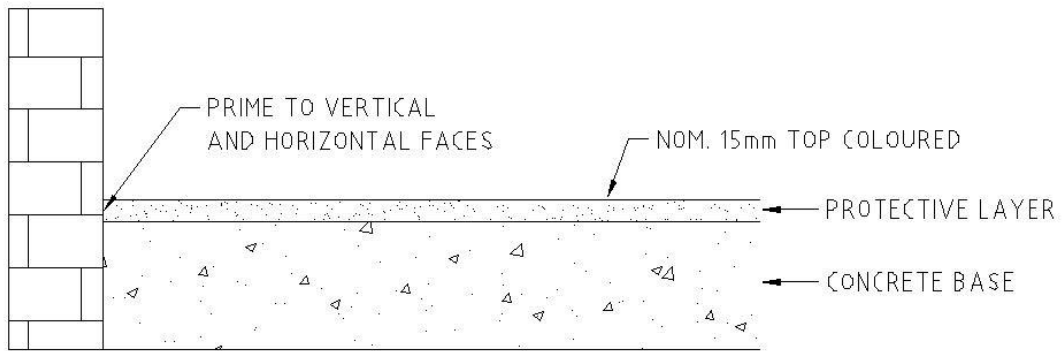
- DUAL LAYER SOFT FALL SURFACE -

Type 4: Rolled thickened edge to soft landscape



- COLOURED PROTECTIVE LAYER ONLY -
TYPICAL EDGE DETAIL FOR - NO EXISTING BORDER

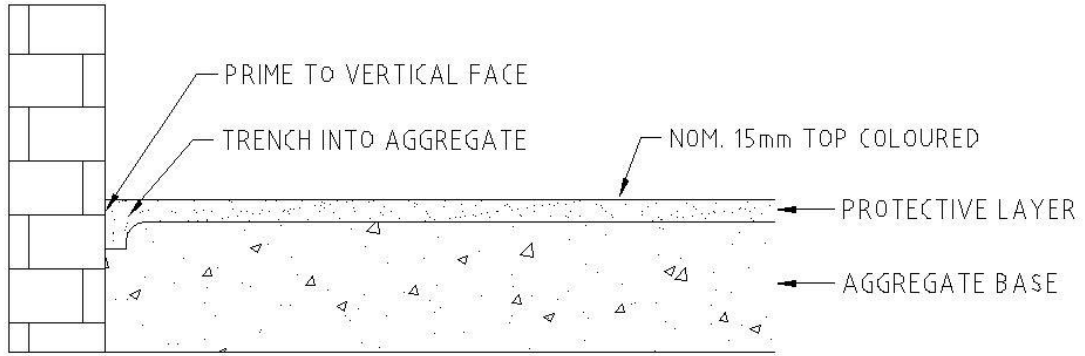
Type 5: Thickened edge to existing hard base



KERB, WALL,
FENCE etc.

- COLOURED PROTECTIVE LAYER ONLY -
TYPICAL EDGE DETAIL FOR "CONCRETE"

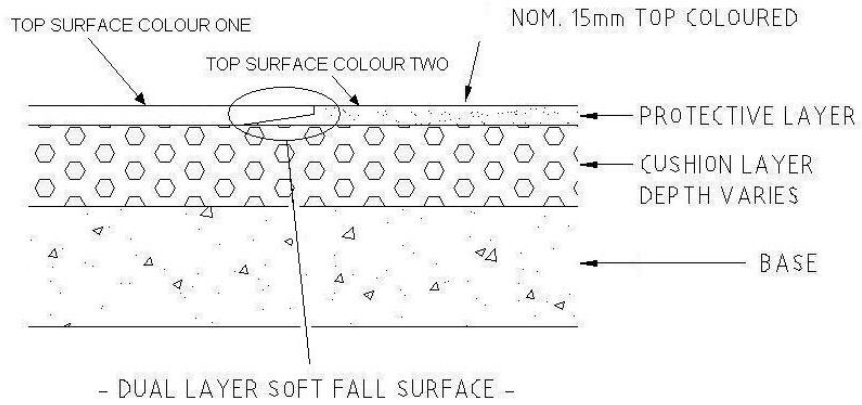
Type 6: Butted edge to vertical / flush edge



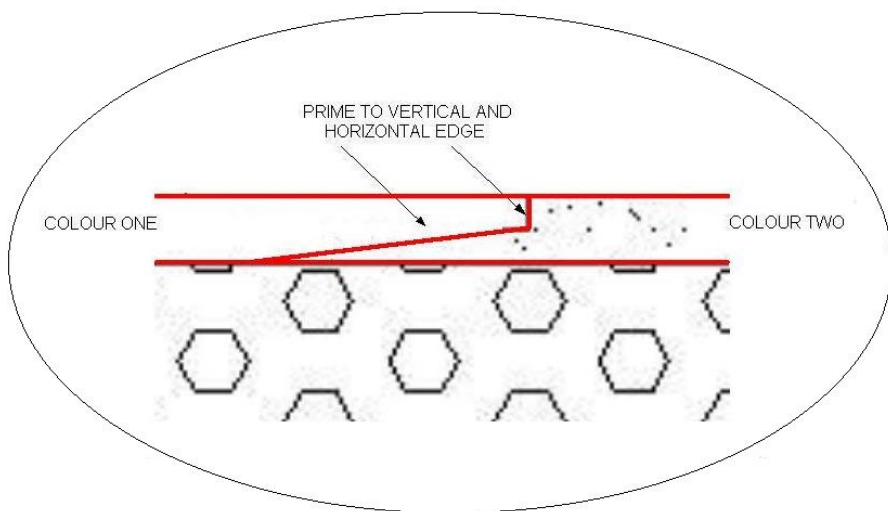
KERB, WALL,
FENCE etc.

- COLOURED PROTECTIVE LAYER ONLY -
TYPICAL EDGE DETAIL FOR "AGGREGATE"

Type 7: Thickened edge to vertical / flush edge



- DUAL LAYER SOFT FALL SURFACE -



Type 8: Key join - day work or colour seam join

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