General Specification
Playground Surfaces Fall-Safe

Soft Fall Rubber - General

Fall-Safe is supplied and installed as a cold wet poured monolithic surface with minimal joins in various thicknesses to meet individual applications such as playgrounds, paths, golf courses and anywhere that requires a long-term hardwearing surface.

Fall-Safe is generally used as a Safety Surface or all purpose wear surface in children's playgrounds. Installed on cushion rubber or by itself over a prepared base this product is free draining and will absorb water through its porous matrix, through the cushion rubber and into the sub-strata.

Standards

The soft fall rubber is to comply with and installed to meet the applicable standards:

- Australian - AS/NZS 4422:1996 & AS4685:2004 Playground Surfacing
- European Standard EN 1177

Note: The Australian Standard is based upon the European Standard EN 1177.

Rubber Crumb Industries Soft fall surfaces are seamless, cast in-situ wet-pour rubber systems designed and installed to meet various Safety Standards throughout the world. As well as having met these safety standards *Rubber Crumb Industries* conducted various testing to meet various material advice listed within these standards. The results of these are shown below with reference made to each applicable standard guideline of each test method.

- Fire Rating in accordance with AS1530 Part 3
- Slip Resistance in accordance with AS3661.1

- Acoustic Test in accordance with supplied method
- Cigarette Burn Resistance
- Chewing Gum Resistance
- Surface Resistance to Heat in accordance with supplied method
- Stain Resistance in accordance with AS298.20 and AS2983.21

TEST RESULTS

Fire Rating

Six specimens of the product were subjected to fire resistance testing in accordance with Australian Standard 1530 Part 3. The following results were obtained:

Ignitability Index	15	Range 0-20
Spread of Flame Index	8	Range 0-10
Heat Evolved Index	10	Range 0-10
Smoke Developed Index	8	Range 0-10

The results of this fire test may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all fire conditions.

Acoustic Test

The product was tested for sound emission in a controlled laboratory environment. A sample area of product was laid and subjected to walking traffic by an 80kg person wearing leather soled shoes. Sound meters were placed in an arc around the area at a distance of 1.5 m from the contact zone. The test was replicated six times to produce a mean sound emission result. The average measured sound level was 35dB, which is equivalent to background noise in a quiet house at night.

Cigarette Burn Resistance

A specimen of the product was exposed to a lighted cigarette both in a drop test and an aggressive extinguishing test. In the first test, a lighted cigarette was dropped onto the surface, left for 10

seconds and then removed and the surface examined. In such an event there was no significant change in the surface and the product may be considered to have good resistance to such an occurrence. In the second test, a lighted cigarette was extinguished by pressing into the surface as can sometimes occur in certain service environments. In the event, there was very minor scalding and marking of the surface finish with a small loss of colour. The product may be considered to also have a good resistance to this type of attack.

Chewing Gum Resistance

A specimen of the product was subjected to contact with chewing gum. The gum used was a common brand readily available on the consumer market. Six replicates were carried out and the chewing gum was pressed onto the product surface and left for periods ranging from 5 minutes to 1 hour to 24 hours. The removal process involved hardening the gum with ice and scraping off with a soft tool. In all cases the gum was completely removed without significant effect to the surface finish. The product may be considered to have a good resistance to this type of soiling.

Surface Resistance to Heat

The product was tested for surface resistance to heat when exposed to an environmental temperature of 30^{0}C as would occur on a warm day. The product (green in colour) was left exposed to the warm conditions for 4 hours prior to measurement of the surface temperature with contact thermocouples. The test was replicated six times to produce a mean surface temperature result.

The average measured surface temperature was 34^{0}C, which shows that the green product does not become too hot to touch after continued exposure to climatic temperatures of 30^{0}C.

Stain Resistance

Specimens of the product were tested for stain resistance in accordance with AS2983.20 and AS2983.21. The product surface was exposed to the agents and chemicals specified by the Australian Standards for a period of 24 hours prior to removal by cleaning and examination of the surfaces for deterioration. The following results were obtained:

Reagent	Effect
Salt Water	Surface Unaffected
Chlorinated Water	Surface Unaffected
Liquid Detergent	Surface Unaffected
Coffee	Surface Unaffected
Tea	Surface Unaffected
Citric Acid 10%	Surface Unaffected
Cola Soft Drink	Surface Unaffected
Felt Tip Marker Pens	Surface Unaffected
Lime	Surface Unaffected
Hydrochloric Acid (15%)	Surface Unaffected
Nitric Acid (5%)	Slight Loss of Gloss
Acetic Acid (20%)	Surface Unaffected
Hydrocarbon Solvent	Slight Loss of Gloss
Diesel Fuel	Slight Loss of Gloss

The product showed excellent resistance to the above reagents but it should be recognised that the material will swell and deteriorate if continuously exposed to spills of hydrocarbon solvents, fuels and oils and its use is not recommended in such environments.

Summary

The performance test results apply to the product samples supplied. The colour of the product would be expected to have little impact on performance based on the test suite conducted. Based on the test results, the product shows excellent resistance to soiling and staining combined with a good resistance to surface heating and a low slip hazard. It appears to be very suitable for use as a playground surface.

Slip Resistance

1.0 INTRODUCTION

A sample of rubber was supplied by *Rubber Crumb Industries* with the request that the frictional properties of the surface be measured in accordance with current Australian Standards.

2.0 DESCRIPTION

The sheet was of normal dimensions 600 x 500mm and was 14mm thick. It appeared to be made of granulated rubber, dark red in colour, and had a rough surface texture.

3.0 METHOD OF ASSESSMENT

The Australian/ New Zealand Standards AS/NZS 3661.1 and 4586 specify the use of the BCRA Tortus Floor friction Tester and the TRRL Pendulum Tester for the measurement of coefficients of friction.

Dry Surfaces:

The Tortus floor tester was used to estimate the dynamic coefficient of friction of the flooring under dry conditions. The Tortus has been designed to reproduce the contact area and pressure of a shoe heel when it touches the ground during walking.

Wet Surfaces:

The dynamic coefficient of friction of the surface in the wet state was assessed from measurements made with the TRL pendulum tester. The machine uses a swinging pendulum with a spring-loaded rubber foot. The pendulum is released from a horizontal position and the rubber foot slides along the test surface; the degree of upswing then depends on the resistance to sliding of the rubber foot along the surface. The water did not spread readily across the surface but it did slowly form a pool. After a few minutes this water had seeped away from the surface into the mat.

4.0 RESULTS

Test Surface	Coefficient of Friction
Dry Leather	0.8
Dry Rubber	0.85
Wet Rubber	0.48

5.0 COMMENTS

AS/ NZS 3361.1 comments:

'When tested in accordance with the method set out in Appendix A (the pendulum test), the pedestrian surface shall have a mean coefficient of friction of not less that 0.4'

'When tested in accordance with the method set out in Appendix B (Tortus test) the pedestrian surface shall have a mean coefficient of friction of not less than 0.4'
AS/NZS 4586 gives a table for pendulum results:

Friction Coefficient	Contribution of the floor surface to the risk of slipping when wet
> 0.55	Very Low
0.45- 0.54	Low
0.35- 0.44	Moderate
0.25- 0.34	High
< 0.25	Very High

1. The surface of the supplied mat would not be regarded as slippery in the dry state.
2. The surface of the supplied mat would be regarded as moderately slippery in the wet state, But which have no known history of slips or falls.

3. If used as a flooring material a slip by a user would be unlikely.

Materials

Three layers of materials are required for most safety surfaces. These are detailed below:

Top Layer

Soft fall rubber material top colour layer is to be from *Entyre* colour range from Rubber Crumb Industries Ltd or approved similar.
The top layer is to be comprised of 1-4mm pre-coloured granules.
Technical Data:

- Tensile Strength 15.9 KN/m
- Elongation at break of

  Bonding material DIN 53571
- Particle Size 1-4mm granule
- Composition Fall-Safe Rubber Consistently pre-coloured 100% Recycled Tyre Rubber Granule blended with pre-polymer in a cold wet process to form a very hardwearing, UV resistant, cushioned surface.
- Flame Resistance Mild fire retardant standard in pre-polymer

Composition

Fall-Safe is a pre-coloured hard wearing granulated rubber with high UV resistant qualities. Using recycled rubber as a base the individual granules, specifically graded at 1-4mm in size, are primed and coloured fully coating the exterior and penetrating the interior providing extra strength to the product. The utilisation of superior colouring pigments and polymers in its manufacture allows for a broad colour range while providing a long term, economical and aesthetically appealing surfacing option. This is then hand batched and layed to *Rubber Crumb Industries* surfacing specifications to meet various surface thicknesses and various polymer ratios to achieve the following:-

- Meet safety criteria as listed in the applicable standards, which reflects *Rubber Crumb Industries'* certified test results.
- Individually meet each surface requirement in areas that require a stronger polymer ratio to meet heavy-duty usage requirements e.g. golf courses, walkways and tracks.

The following densities are applicable for *Fall-Safe* for playground and general use applications (these figures cover the combination of both the Top Layer and the Cushion Layer).

Thickness	Fall Height	Density m^3
15mm	0-500mm	796.66 kg
40mm	500mm-1.25metres	709.50 kg
50mm	1.25m – 1.6 metres	699.04 kg
75mm	1.6m-2.3 metres	644.66 kg
90mm	2.3m – 2.5 metres	594.99 kg

Cushion Layer

The cushion layer is to be comprised of Recycled SBR Tyre Rubber to graded size (8-15mm) as to match manufacturers test specifications. The material used is to be clean of all contaminants such as nylon and have no loose wire fibres.

The cushion layer is to be mixed as per the top layer in a specified pre-polymer polyurethane & rubber ratio to *Rubber Crumb Industries'* specifications and installed at thickness and density to match the certified soft fall testing. The soft fall plan supplied prior to the commencement of each project should reflect the laid thickness minus the specified top layer thickness.

The base layer is to be laid as a single monolithic surface with minimal joins in the same fashion as the top layer.

Base Layer

Standard Base Layer Preparation

The base layer is to be prepared to a high standard to ensure surface quality and to prevent future subsidence and growth of plant matter through the surface. The following materials and recommendations outline the different options available for surfacing projects.

Base Material

Rubber Crumb Industries has a number of different recommendations for base material to be used a footing to the above mentioned “cushion and top layers”. Highly compacted materials such as subkha, ground blue metal dust, crushed limestone and their equivalents are all highly recommended bases as they provide not only a secure strata but are free draining and an extremely economical alternative to concrete. A free-formed base also allows for a greater variety of thicknesses to be utilised, which is unviable using concrete.

Below are some useful guidelines that should be followed which will give the best results when doing the base preparation for a *Fall-Safe* surface. From this point on the base material will be referred to as “subkha or equivalent”

1. Existing Sand Area

   A 50mm to 100mm pad of 4mm diameter compacted “subkha or equivalent” should be installed over the existing sand. The existing sand should be levelled out and all organic matter removed prior to the installation of the compacted base pad. The compacted base pad must be sufficiently wetted and compacted to a level firm finish.

2. Existing Turf Area

   All of the turf and associated root system along with all other organic matter must be removed and a 50mm pad of “subkha or equivalent” should be installed over the turfed area. The base pad must be sufficiently wetted and compacted to a level firm finish.

3. Existing Concrete Area

   The concrete should be cleaned and allowed to completely dry and all loose material thoroughly removed prior to installation of surface directly over concrete pad. If the existing concrete is polished or has a similarly textured surface the area should be scoured to allow a suitable “key” for the new surface to bind to.

New Concrete Area

New concrete should be left to cure for 10-14 days prior to rubber surface being applied and should have no more than 10% water content before commencement of surfacing. The concrete should have a lightly “broomed finish” to provide an adequate “key”. Adequate drainage should be available for recessed concrete base areas.

4. Existing Paved Area

Follow the same steps as for Existing Concrete Area however it is important to ensure that pavers are level, as the rubber surface will follow the contour of the paved surface.

Failure to plan adequate base layer preparation will potentially result in adverse effects in long-term surface quality and standards.

Typical Section