

ABN 36 062 949 973  
20/109A Bonds Rd Punchbowl NSW 2196**Test Report**  
**for the determination of Critical Fall Height for**  
**“Under Playground Surfacing with Plants”****Specification:** Australian Standard AS/NZS4422:1996 Amdt 1  
Playground surfacing Specifications, requirements and test method

<b>Client:</b>	OZ Breed 14 Cupitts Lane Clarendon NSW 2756
<b>Contact:</b>	Katrina Layt
<b>Date of Test:</b>	15 August 2012
<b>Location of test</b>	14 Cupitts Lane Clarendon NSW 2756
<b>Date of Report:</b>	30 August 2012
<b>Report Number:</b>	2956

**Acousto-Scan is an Accredited ISO/IEC 17025 NATA Laboratory and  
ISO 9001 Quality Company**Date  
30 Aug 2012

Laboratory Director



Grant Humphreys

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### Material Identification: Under Playground Surfacing

The product comprised of 1. Playbark Area A Mulch 10 - 15 mm bark chips with plants  
2. Port Stephens Pine Area B Mulch 10 – 15 mm bark chips and with plants

### Archiving:

None

**Dates of test:** 15 Aug 2012

**Location of Testing:** OZbreed 14 Cupitts Lane  
Clarendon NSW 2756SW 2196, Australia

**Temperature (surface):** Dry test 17°C

**Testing to:** Australian test method AS/NZS4422:1996 Amdt 1

The prepared samples of material were tested in accordance with Australian test method AS/NZS4422:1996 Amdt 1. This method involves impacting the material with an instrumented head-form and measuring the deceleration of the head-form on impact. Two impact parameters are determined from the recorded acceleration-time relationship - the Head Injury Criterion (HIC) and the maximum deceleration produced (G-max).

HIC is a measure of the severity of the impact and takes into account the time duration of the impact as well as its magnitude. It is defined in the Standard by the following integral formula:

$$HIC = \left[ (t_2 - t_1) \left\{ \frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a \cdot dt \right\}^{2.5} \right]_{\max}$$

where  $t_1$  and  $t_2$  are times between the starting and finishing times of the impact chosen to maximise the function, and  $a$  is the instantaneous value of deceleration during the impact measured in  $g$ , the acceleration due to gravity.

The critical fall height (CFH) for a particular surfacing material is the lowest drop height of the head-form, which produces an HIC of 1000 and a G-max of 200 G, whichever is the lower. These threshold values, which determine the critical fall height, are set in regard to minimising head injuries resulting from an impact of a human head with a surface. Thus, the greater the critical fall height, the safer is the surfacing material. This critical fall height can be referenced to the platform heights of particular items of playground equipment installed in playgrounds from which children might fall.

The fall height has been calculated relative to the nominated piece of equipment, and that no assumption has been made about the height of the user above that equipment.

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**Test equipment:**

The following test equipment conforming AS/NZS4422:1996 Amdt 1 was used.

**Head-form:** Aluminium alloy head-form #, AS0005  
ISO Size J, mass 5.0 kg

**Equipment:** Uniaxe-II impact tester #AS0019

**Calibration factor:** 4 mV/g (g = 9.80665 m/s/s)

**Drop method:** guiding rails

**Timing:** infra-red gates

**Errors and Uncertainties:**

The Standard AS/NZS4422:1996 Amdt 1 Appendix A calls for an expression of critical fall height rounded down to the nearest 0.1 m.

Uncertainties were calculated in accordance with the ISO Guide to the Expression of Uncertainty in Measurement ISO/IEC GUIDE 98-3:2010

Uncertainty Confidence Level = 95%: Coverage Factor k=2

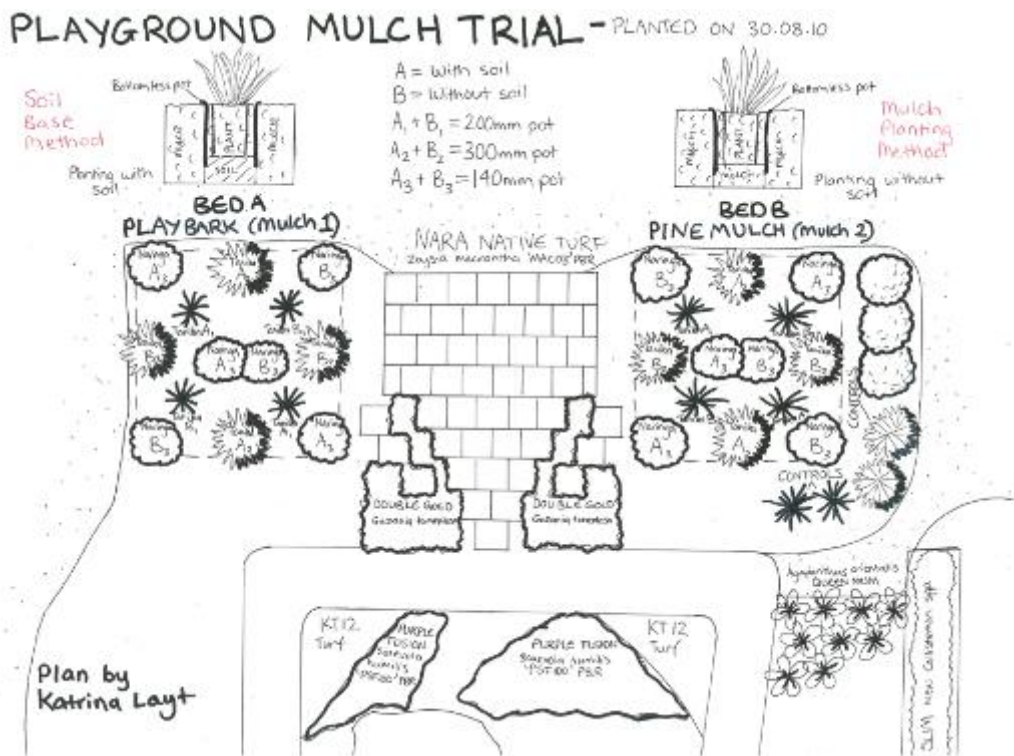
**Procedure:**

Two types of bark mulch were tested for impact attenuation to Australian Standard AS/NZS4422:1996 Amdt 1 Playground surfacing Specifications, requirements and test method .

The testing was carried out in accordance with Acousto-Scan's Work Instruction L4\_09\_05 All equipment was in calibration and traceable to national Standards.

The maximum G-max and HIC were recorded and later entered into the processing sheet.

Fig1: Layout of positions



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## Results

Test Date	Test	Material Test Conditions	Critical Fall Height	Material Allowance
30 August 2012	1	Pine Mulch (Mulch 2)-M3 Indentation	5.9 m	60mm
30 August 2012	2	Pine Mulch (Mulch 2) Dead Tanika	6.2 m	60mm
30 August 2012	3	On Soil outside test area	1.4 m	20mm
30 August 2012	4	Pine Mulch (Mulch 2) On Naringa plant	5.9 m	60mm
30 August 2012	5	Playbark (Mulch 1) On Tanika with soil	6.2 m	60mm
30 August 2012	6	Playbark (Mulch 1) On Tanika without soil	4.4 m	60mm
30 August 2012	7	Playbark (Mulch 1).	3.2 m	60mm
30 August 2012	9	Playbark (Mulch 1).-Dead Tanika	3.2 m	60mm
30 August 2012	10	Soil outside test area	1.8m	20mm

The Australian Standard AS/NZS4422:1996 Amdt 1 details the usage of impact absorbing materials in children's playgrounds and defines relevant terms and conditions.

The fall height has been calculated relative to the nominated piece of equipment, and that no assumption has been made about the height of the user above that equipment.

Loose fill material should be installed to the depth shown in the test report, which should be not less than 200 mm. And because it will deteriorate during use, an additional depth (the material allowance) should be laid. In high traffic areas, such as under swings and slippery dips, an additional 20% in depth is recommended .

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Photo 1: Pine Mulch (Mulch 2)-M3 Indentation



Photo 2 Pine Mulch (Mulch 2) Dead Tanika



Photo 3: On Soil



Photo 4 Pine Mulch (Mulch 2)- On Naringa plant with soil



Photo 5 Playbark On Tanika with soil



Photo 6 Playbark- On Tanika without soil



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Photo 7 Playbark



Photo 8 Playbark- Dead Tanika



Photo 9 On Soil



Photo 10 Pine Mulch (Mulch 2)



**Comments:**

Two types of bark mulch were tested for impact attenuation to Australian Standard AS/NZS4422:1996 Amdt 1 Playground surfacing Specifications, requirements and test method .

It was observed that there were no hard areas due to roots or root matting .

The dead plant root ball was small and when impacted on, the CFH was 3.2m

The CFH minimum for the two complete areas was 3.2m .

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