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Test Report
for the determination of Critical Fall Height for
“Re test from 2012 to 2014
Under Playground Surfacing with Plants”

Specification: Australian Standard AS/NZS4422:1996 Amdt 1
Playground surfacing Specifications, requirements and test method

Client:	OZ Breed 14 Cupitts Lane Clarendon NSW 2756
Contact:	Katrina Layt
Date of Test:	3 February 2014
Location of test	14 Cupitts Lane Clarendon NSW 2756
Date of Report:	10 March 2014
Report Number:	3153

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ISO 9001 Quality Company**

Date
10 March 2014

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: 3 Feb 2014

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

Temperature (surface): Dry test 27°C
Wet 27°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

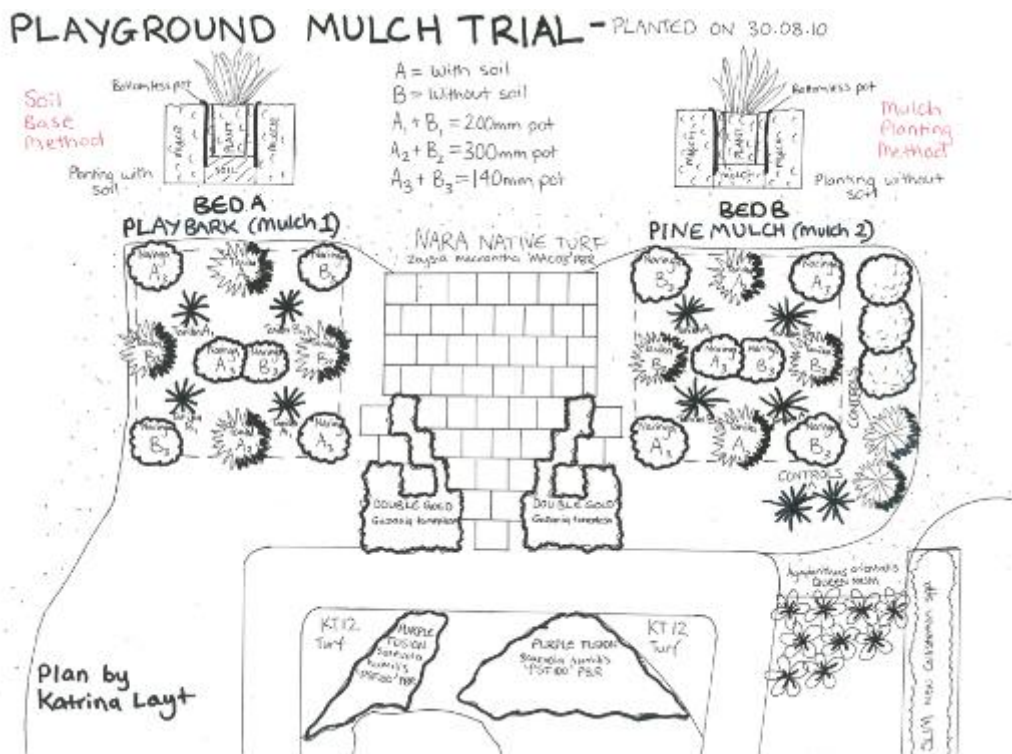
Procedure:

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 Dry

Test Date	Test	Material Test Conditions	Critical Fall Height	Material Allowance
3 February 2014	1	Pine Mulch (Mulch 2)-M3 Indentation	3.5 m	60mm
3 February 2014	2	Pine Mulch (Mulch 2)Dead Tanika	3.4 m	60mm
3 February 2014	3	On a Tanika plant without soil	5.7 m	70mm
3 February 2014	4	Pine Mulch (Mulch 2)Mulch - On Naringa plant	6.3 m	60mm
3 February 2014	5	Playbark pine bark mulch (Mulch 1). On Tanika with soil	6.7 m	60mm
30 August 2012	6	Playbark pine bark mulch (Mulch 1). On Tanika without soil	3.9 m	60mm
3 February 2014	7	Playbark pine bark mulch (Mulch 1).	5.3 m	70mm
3 February 2014	9	Playbark pine bark mulch (Mulch 1). Dead Tanika	5.2 m	60mm

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Results Wet

Test Date	Test	Material Test Conditions	Critical Fall Height	Material Allowance
3 February 2014	1W	Pine Mulch (Mulch 2) -M3 Indentation	4.5 m	60mm
3 February 2014	2W	Pine Mulch (Mulch 2) Dead Tanika	4.5 m	60mm
3 February 2014	3W	On a Tanika plant without soil	3.9 m	20mm
3 February 2014	4W	Pine Mulch (Mulch 2) On Naringa plant	4.3 m	60mm
3 February 2014	5W	Playbark (Mulch 1). On Tanika with soil	4.4 m	60mm
3 February 2014	6W	Playbark (Mulch 1). On Tanika without soil	4.4 m	60mm
3 February 2014	7W	Playbark (Mulch 1).	5.7 m	60mm
3 February 2014	9W	Playbark (Mulch 1). Dead Tanika	6.2 m	60mm

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 (Mulch 1). on Tanika with soil without soil



Photo 6 Playbark (Mulch.1) On Tanika



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Photo 7 Playbark (Mulch 1).



Photo 8 Playbark (Mulch 1).- Dead Tanika



Photo 9 On Soil



Photo 10 Pine Mulch (Mulch 2)



Comments:

Retest of plant area. Last test 2012.

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 6.2m
The CFH minimum for the two complete areas was 4m.

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