

Impact Surface Requirements

(Based on AS 4685 & AS 4422)



Introduction

This document is a summary of requirements relating to the extent of impact attenuation and the specified fall heights as detailed in the following Standards:

- AS 4685 – 2014 (parts 1-6) – Playground equipment – General safety requirements and test methods + Additional specific requirements for swings; slides; runways; carousels; rocking equipment
- AS 4685 – 2012 (part 11) – Playground equipment – Additional specific safety requirements and test methods for spatial networks
- AS 4685.0:2017 – Playground equipment and surfacing – Development, installation, inspection, maintenance and operation
- AS 4422:2016 – Playground surfacing – Specifications, requirements and test method

Some of the explanations relating to individual items of equipment have been expanded and reflect the opinions of the author of this document.

It should be noted that in some cases a manufacturer may specify a 'free height of fall' or a required 'impact area' that is in excess of that generally recommended in the Standards for a particular piece of equipment. In such cases the recommendation of the manufacturer should be used.

Playground surface impact testing recommendations

The following testing frequencies are detailed in AS 4685.0–2017:

- Post-installation inspection of unitary (e.g. rubber) surfacing in accordance with the requirements of AS 4422.
- Unitary (e.g. rubber) surfacing should be tested at least every 3 years.
- Loose-fill surfaces need not be impact attenuation tested on a regular basis providing:
 1. the generic product typically complies with the requirements of AS 4422 when tested; and
 2. that the material is maintained at a minimum depth of 200 mm (or greater where free heights of fall require a greater material depth).

Definitions

Free height of fall (FHOF)

The free height of fall of any component of playground equipment is defined as the greatest vertical distance from the point of clearly intended body support to the impact area below. (There are some variations in the way this is measured for specific items of equipment, as detailed in the following pages.)

Measured fall height

When on-site impact testing is carried out the Standard (AS 4422-2016) requires that the surface is tested at or above the 'measured fall height', which is the 'free height of fall' with an additional 10% allowance. This is to allow for variations in the surface's performance from one location to another.

Impact Area

The surface that can be hit by a user falling. This was formerly referred to as the 'fall zone'. The extent of the impact area for various items of equipment are detailed in the following pages.

Critical fall height

The maximum free height of fall for which a surface will provide an adequate level of attenuation. In the case of some items which involve forced movement (carousels, slide exits, flying foxes), the surface below requires a critical fall height which is greater than the actual free height of fall. These variations are detailed in the following pages.

Forced movement

Movement of the user caused by the equipment (e.g. swinging, sliding, carousel rotation, etc.) which, once started, cannot be totally controlled by the user. This includes slides where the forces of gravity influence the movement of the user.

Surfacing requirements

Equipment with fall heights below 600mm

There is no impact attenuating surface requirement for equipment with a FHOF of less than 600mm unless forced movement exists (see below).

Equipment with fall heights above 600mm and below 600mm where forced movement exists

For equipment with a free height of fall above 600mm and below 600mm where forced movement exists, the surfacing requirements shall meet the requirements of AS 4422:2016 (Playground surfacing – specifications, requirements and test method), as outlined in the following pages.

Free height of fall (FHOF)

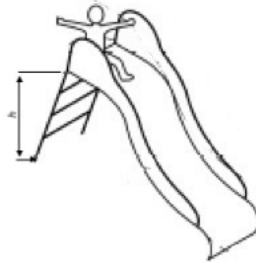
The point of clearly intended body support for various types of use is generally measured as detailed in the following chart. The FHOF for some individual items of equipment, particularly where forced movement is involved, varies as detailed in the following pages.

Type of use	Measurement basis
Standing	From foot support to surface below
Sitting	From seat to surface below
Hanging (when full body support is provided by the hands only)	From hand support to surface below
Climbing (when body support is a combination of hands & feet)	From highest accessible foot support to surface below
Fireman's Poles & Climbing Ropes (when body support is a combination of hands & feet/legs, & no clear foot-support exists closer than 1m from the highest hand-hold)	From maximum hand support, minus 1m to surface below

Examples of general means of determining FHOF



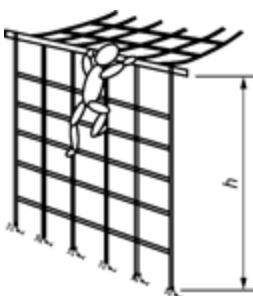
Standing



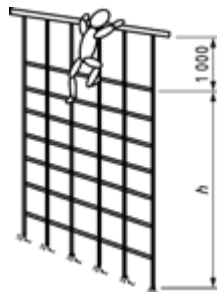
Sitting



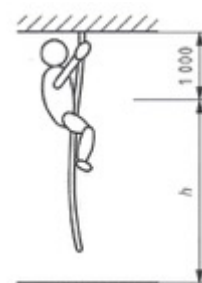
Hanging
(Overhead items, including track rides and chin-up bars)



Climbing (general)



Climbing
(where no clear foot-support exists closer than 1m from highest hand-support)



Fireman's poles & climbing ropes

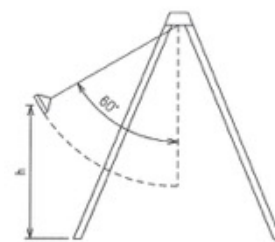
Variations in specific equipment types

Swings

FHOF is measured from the middle of the seat to the surface below when raised at 60° to the vertical.

This can simply be calculated using the following formula:

Length of the suspension member (seat to pivot point) ÷ 2 + height of swing seat at rest.



Slides (run-out section)

The impact area around the run-out section of the slide shall have a critical fall height of at least 1000 mm.

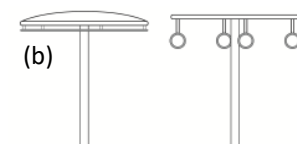


Carousels

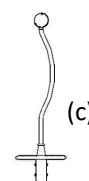
(a) Standard Carousels – The impact area around carousels shall have a critical fall height of at least 1500 mm. (This is likely to be reduced within the next 12 months as the playground Standard is updated.)



(b) Overhead Carousels – FHOF is measured as the grip/seat height (if the grips are flexible, angled at 30°) minus 1500mm, but the critical fall height of the surface must be at least 1000mm.

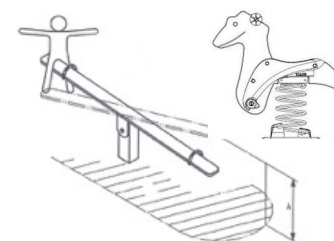


(c) Spinning Poles (< 500mm diameter) – FHOF is measured as the platform height to the ground below.



Rocking Equipment

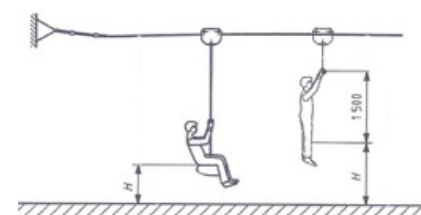
FHOF is measured from the seat, in its most extreme position, to the ground below.



Flying Foxes

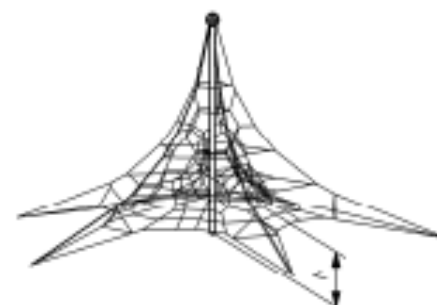
FHOF is measured from the seat (unloaded) to the surface below or from the grip position (unloaded) minus 1.5 m to the surface below.

The surface below a flying fox shall have a critical fall height of at least 1250 mm.



Activity Nets

FHOF is measured from the highest foot position giving an unimpeded fall to the surface below. (Falls from higher portions of the net will be broken by the net structure below.)



Impact area (formerly referred to as ‘fall zone’)

The impact area is the area that can be hit by a user falling from the playground equipment. The dimensions of the impact area are shown in Figure 4 and Tables 2 and 3.

In certain cases, as outlined in Table 3, the possible movement of a particular type of equipment and the user may require that the impact area be extended to provide adequate protection against falling injuries.

The impact area increases for free heights of fall above 1.5m in accordance with the dimensions shown in Figure 4. This requirement may be increased in certain cases of forced movement, or decreased if the equipment is fully enclosed or installed on or against a wall.

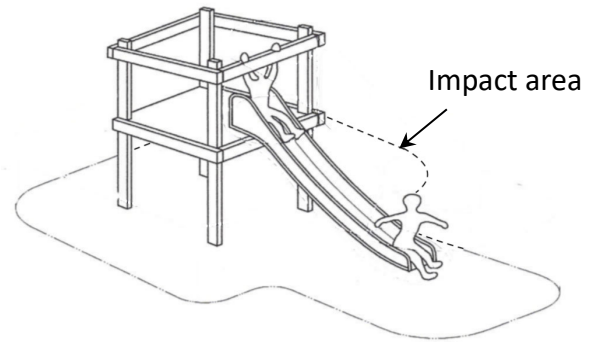
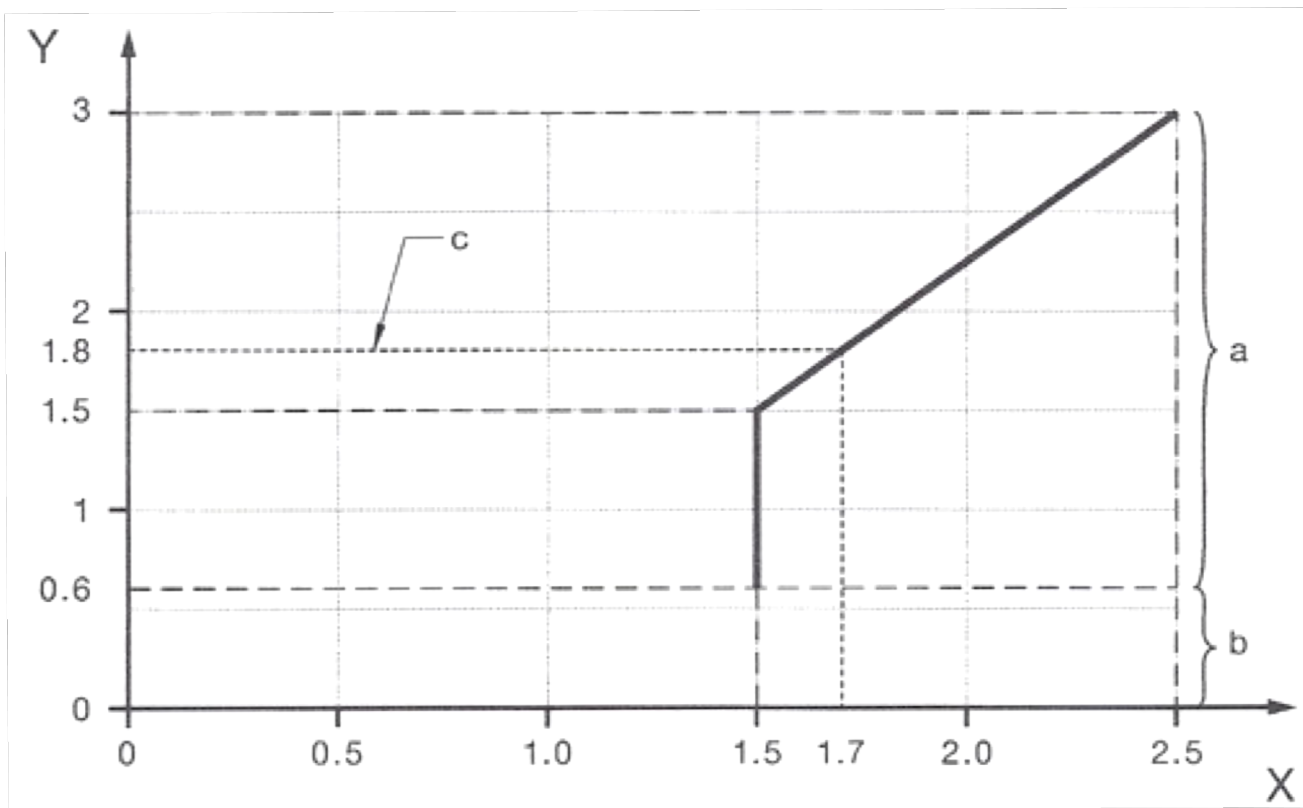


Figure 3 – Example of impact area



- Y free height of fall (FHOF)
- X minimum dimension of impact area
- a impact attenuating surface required
- b no impact attenuating surface required unless forced movement
- c maximum FHOF and fall zone for SECS

Figure 4 – Extent of the impact area

Table 2 – Extent of the impact area (general requirements)

If $Y > 1.5\text{m}$, then $X = \frac{2}{3}Y + 0.5\text{m}$

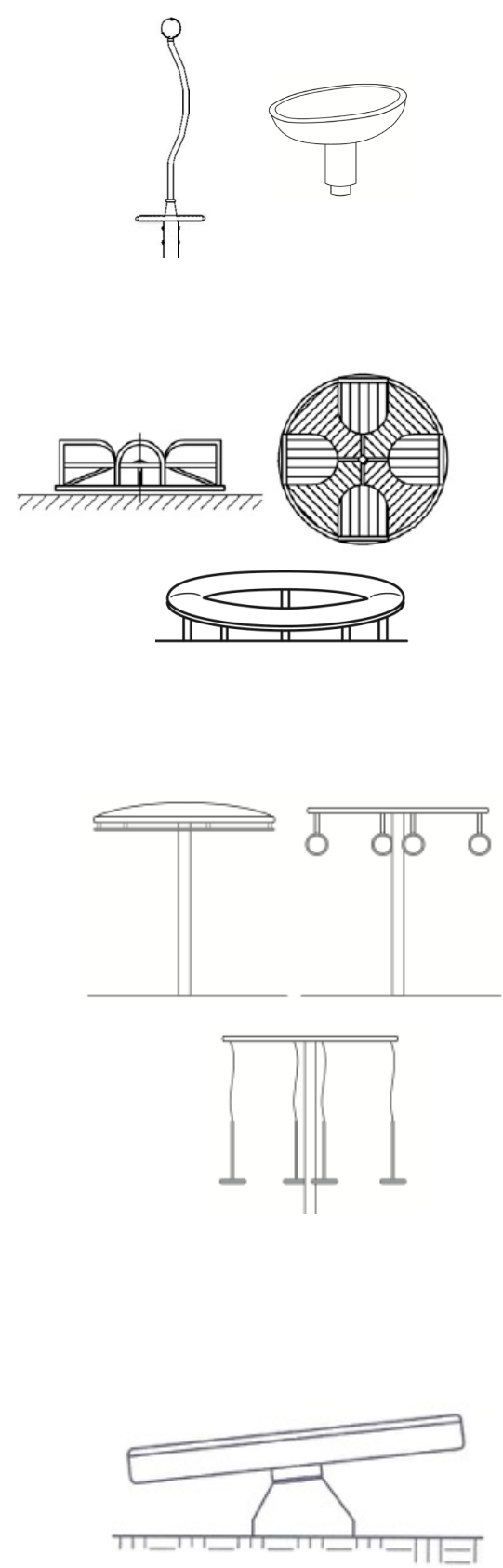
This table provides dimensions for heights in increments of 100mm

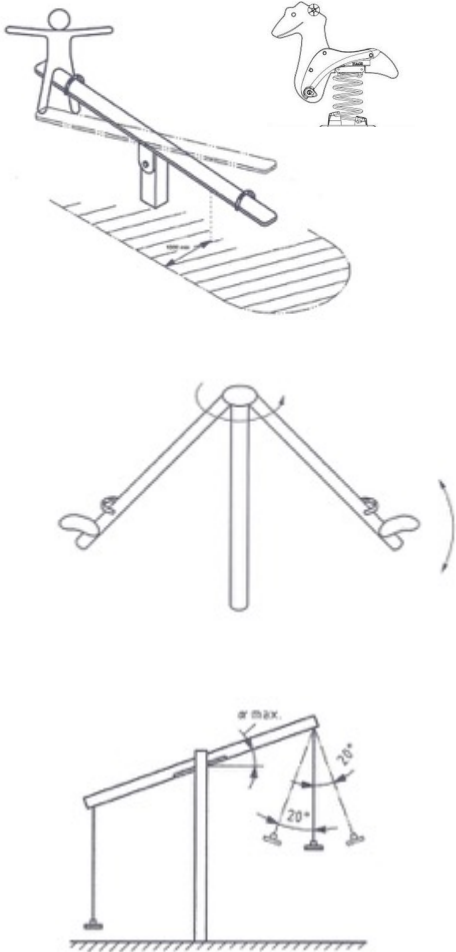
FHOF	Extent of impact area	Surfacing requirements
No forced movement < 0.6m	≤ 1500mm	Surface with no requirements
Forced movement < 0.6m	Slide exit - 2000m end & 1000m sides	Impact attenuating surfacing tested in accordance with AS/NZS 4422:1996
	Spring Rocker – 1000mm	
	Carousel – 2000mm * ¹	
$0.6\text{m} \leq h \leq 1.5\text{m}$	1500mm	
1.6m	1567mm	
1.7m	1633mm	
1.8m	1700mm	
1.9m	1767mm	
2.0m	1833mm	
2.1m	1900mm	
2.2m	1967mm	
2.3m	2033mm	
2.4m	2100mm	
2.5m	2167mm	
2.6m	2233mm	
2.7m	2300mm	
2.8m	2367mm	
2.9m	2433mm	
3.0m	2500mm	

1. The falling space for larger inclined carousels increases to 3000mm and for small bowl-like carousels & spinning poles reduces to 1500mm.

**Table 3 – Extent of the impact area
(specific requirements based on movement)**

Equipment Type	Extent of impact area	Diagrams
<p>Swings</p>	<p>LENGTH</p> <p>The minimum length of the impact area (L) is equal to A + B or A + C, where:</p> <p>A = the horizontal distance when the seat has travelled through an arc of 60°, which can be calculated as the length of the suspension member (h) x 0.867.</p> <p>B = 1750mm, where the surface is level with the surrounding surface (normally synthetic), or in all cases in SECS settings. In this instance there should be an additional area extending 500m that is free from obstacles.</p> <p>C = 2250m, where the surface is contained (normally loose fill).</p> <p>WIDTH</p> <p>The minimum width of the impact area (W) below each swing seat with a width of less than 500mm shall be 1750mm. If the seat is wider than 500mm the width of the impact area shall increase by the difference between the actual width and 500mm.</p> <p>In the case of single point swings (which allow movement through more than one axis or plane) the extent of the impact area shall be circular with a radius calculated above as L.</p>	
<p>Slides</p>	<p>TO THE SIDES</p> <p>The impact area to the sides of the slide shall correspond to the general FHOFF requirements for the height of the slide at various points where the height of the sliding surface is 600mm or above. Where the sliding surface is below 600mm the impact area shall extend at least 1000mm to the sides of the run-out section.</p> <p>FROM THE END</p> <p>The impact area beyond the run-out section is dependent on the type of slide as follows:</p> <p><u>Type 1:</u> (most slides fall into this category)</p> <p>Impact area to extend 2000mm beyond the run-out section, with the end having a 1000mm radius in line with the outside edge of the slide.</p> <p>The run-out section is inclined to 10° maximum, and is at least the following length:</p> <ul style="list-style-type: none"> - 300mm if the sliding section is < 1500mm in length. - 500mm if the sliding section is between 1500mm and 7500mm in length. - 1500mm if the sliding section is > 7500mm in length. <p><u>Type 2:</u> (generally very long slides)</p> <p>Impact area to extend 1000mm beyond the run-out section, with a 1000mm radius from the outside edge of the slide.</p> <p>Run-out section inclined to 5° maximum, with a length 0.3 x the length of the sliding section.</p>	<p>A starting section B sliding section C run-out section Ra depending on the FHOFF b depending on the type of run-out section</p>

Equipment Type	Extent of impact area	Diagrams
<p>Carousels</p>	<p>SPINNING POLES (diameter < 500mm) & BOWL TYPE CAROUSELS</p> <p>The impact area shall extend at least 1500mm from the outside of the standing platform/bowl.</p> <p>STANDARD CAROUSELS & REVOLVING RINGS</p> <p>The impact area shall extend at least 2000mm from the outside of the carousel.</p> <p>OVERHEAD CAROUSELS</p> <p>The impact area shall extend at least 2000mm from the outside of the carousel.</p> <p>In the case of carousels with flexible grips/seats, the impact area is measured from the grips/seats when they are angled out by 30°.</p> <p>In addition, the area extending 1.0m beyond the impact area shall be free of obstacles.</p> <p>REVOLVING DISK (on an inclined axis with no clearly definable user stations)</p> <p>The impact area shall extend at least 3000mm from the outside of the carousel.</p>	 <p>The diagrams illustrate various carousel types: <ul style="list-style-type: none"> A spinning pole with a ball at the top and a base. A bowl-shaped carousel with a central pedestal. A standard carousel with a platform and a top view showing four seats. A revolving ring with a platform and a top view showing a circular ring. An overhead carousel with a flat top and a central pole. An overhead carousel with a horizontal bar and four seats hanging from it. An overhead carousel with a horizontal bar and three seats hanging from it. A revolving disk on an inclined axis with a base. </p>

Equipment Type	Extent of impact area	Diagrams
Rocking Equipment	<p>STANDARD ROCKING EQUIPMENT</p> <p>The impact area shall extend at least 1000mm beyond the perimeter of the equipment when in its most extreme position.</p> <p>SWEEPING SEESAW (in which both vertical and horizontal movement takes place, which may result in a sweeping motion.)</p> <p>The general requirements for the extent of the impact area apply based on the height of the user stations when in their extreme position. The general requirements then apply for that height.</p> <p>OVERHEAD SINGLE AXIS SEESAW (with a single overhead rocking axis, where the user stations are flexibly suspended below and provide and additional limited swinging motion.)</p> <p>The general requirements for the extent of the impact area apply based on the height of the user stations when angled at 20° from the vertical.</p>	
Cableways	<p>TO THE SIDES</p> <p>The impact area shall extend at least 2000mm to each side of the cableway.</p> <p>FROM THE ENDS</p> <p>The impact area shall extend at least 2000mm beyond the end of the handgrip or seat when swinging at an angle of 45° from the compressed end stop, with the width reducing to an overall width of 2000mm.</p>	