



# PIPA Technical Bulletin

## TB08 (interim) – Anchorage Calculations

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<b>Title</b>	Interim Update on Anchorage Calculations		

<b>Version</b>	<b>Date</b>	<b>Notes</b>
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HSE are due to release ETIS07 later in 2024 – Entertainments Information Sheet “Safe operation of play inflatables, including bouncy castles”. This document is HSE’s clarification on HSG175 specific to play inflatables.

### **Updated HSE Position following Anchorage research and subsequent findings Report**

Following a number of high-profile incidents involving inflatables, HSE have in recent years conducted extensive research through their own inhouse testing laboratory into the effectiveness of anchors on inflatable devices.

HSE has stated in the new ETIS07 document : *“High level anchors are there to retain the inflation shape and be set with a degree of slack in securing ropes. High level anchors do not fully count in securing the inflatable base to the ground.”*

With this in mind – we need to ensure PIPA inspections are conducted in line with current guidance. Particularly as anchorage is such a safety critical component within inflatable devices.

PIPA has received clarification from HSE stating that only anchors on the base should be included within the anchorage calculation. We have also obtained clarification on the use and position of corner anchors.

The exception to this is where the manufacturer has produced calculations showing the anchorage effect of anchors not on the base (e.g. a top-level anchor may produce 20% anchorage efficiency compared to a base anchor).

There are a number of considerations around this. To this effect PIPA has produced this interim technical bulletin. Work has been underway for some time on a larger technical bulletin about anchorage, and this will be released in the future.

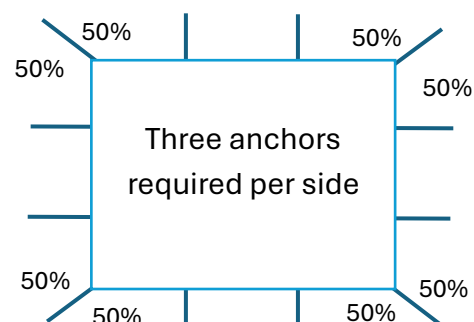
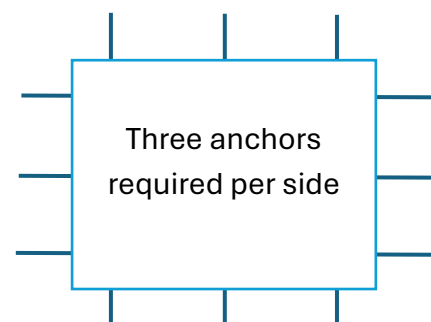
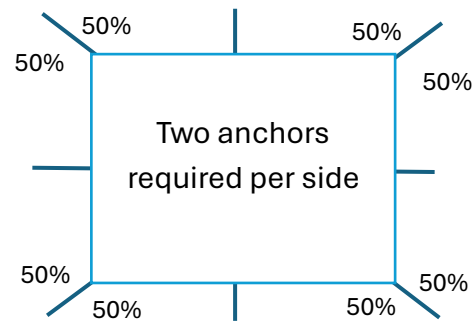
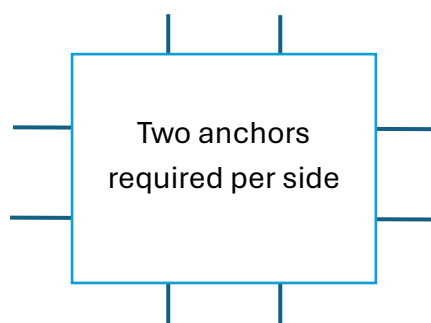
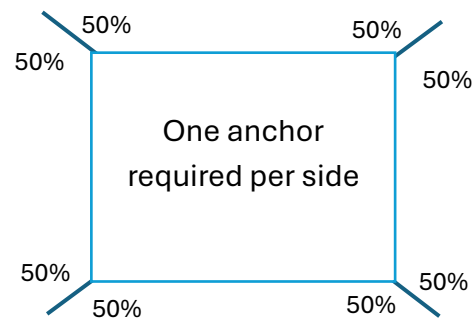
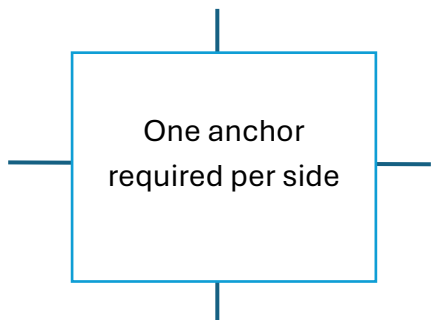
### **Definitions**

*“Base Anchor”*: When we refer to a base anchor, we mean the lowest anchor point seam which is used to provide the strongest anchorage to the ground.

*“Additional Anchor”*: Any anchors which are above the lowest anchor point, are considered to be used for structural purposes. Whilst they provide a degree of anchorage, the degree of efficiency is less than that of a base anchor.

*“Anchorage Efficiency”*: Where a base anchor is considered to provide 100% efficient, additional anchors may have lesser efficiencies (e.g. they may only provide 20% anchorage in comparison). These must only be considered where the manufacturer can provide written guidance on the actual effectiveness of each of the high anchor points present.

“Corner Anchors”: Where anchors are located directly on the corner of the device (see diagram below). In BS EN 14960, it states “Note – corner anchors count 50% on each side.”



## Methods to calculate anchorage

BS EN14960 calculation:

$$\frac{Area * 114 * 1.5}{1600} = \textit{Minimum number of anchor points}$$

There should be no less than 6 anchor points on an inflatable.

PIPA recommends conducting the box method in the first instance, before moving onto the complete surface area method if needed. If there are enough anchors from the box method, there is no reason to conduct the complete surface area method. However, if there are not enough anchors in the box method, we recommend completing the surface area method as this will produce a more accurate result which is relevant to the shape of the device.

Remember, the method below needs to be completed for each side of the device independently.

- **1) Box method**

The box method is the simplest of calculations, it uses the tallest part and the longest part of the device to produce a result.



Box surface area = 6.0m x 6.9m = 41.4m<sup>2</sup>

Calculation =

$$\frac{Area * 114 * 1.5}{1600} = 4.42 \text{ (i. e. 5 anchors are required on this side)}$$

This method needs to be completed for each side.

## - 2) Complete Surface Area Method

The complete surface area requires breaking down the inflatable into smaller calculations of surface area, to obtain a more specific result.



Surface area (note – example is not to scale):

1.  $1.9\text{m} \times 1.4\text{m} = 2.660 \text{ m}^2$
2.  $(1.9\text{m} \times 0.7\text{m}) / 2 = 0.451 \text{ m}^2$
3.  $(1.0\text{m} \times 0.5\text{m}) / 2 = 0.250 \text{ m}^2$
4.  $1.0 \text{ m} \times 1.0\text{m} = 1.000 \text{ m}^2$
5.  $(0.4\text{m} \times 0.6\text{m}) / 2 = 0.120 \text{ m}^2$
6.  $0.6\text{m} \times 5.1\text{m} = 3.060 \text{ m}^2$
7.  $(0.6\text{m} \times 0.4\text{m}) / 2 = 0.120 \text{ m}^2$
8.  $(0.6\text{m} \times 0.3\text{m}) / 2 = 0.090 \text{ m}^2$
9.  $0.6\text{m} \times 1.5\text{m} = 0.900 \text{ m}^2$
10.  $(2.5\text{m} \times 0.3\text{m}) / 2 = 0.750 \text{ m}^2$
11.  $5\text{m} \times 1.3\text{m} = 6.500 \text{ m}^2$
12.  $4.4\text{m} \times 0.52\text{m} = 2.288 \text{ m}^2$

Sum of the 12 above areas = 18.189 m<sup>2</sup>

Calculation =

$$\frac{18.189 * 114 * 1.5}{1600} = 2.46 \text{ (i. e. 3 anchor points on this side)}$$

### **Determining sufficient anchorage**

Step 1) Complete your calculations for the required number of anchor points – for each side independently

Step 2) Has the manufacturer provided any evidence to show the anchorage efficiency of additional anchor points – this must be in writing and saved on your inspection report

- Yes: Continue to step 3
- No: Continue to step 4

Step 3) Perform the following calculation:

- Number of base anchors
- Additional anchor points x anchorage efficiency (repeat if different anchors provide different anchorage efficiency)
- The sum of the above = number of anchor points
- Continue to step 5

Step 4) Perform the following calculation:

- Number of base anchors = number of anchor points

Step 5) If number of anchor points equals or exceeds step 1, there is sufficient anchorage. If it is less than step 1, then additional anchor points are required.

### **Operational Matters**

All anchor points must be in use during the operation of an inflatable device.

### **Anchor point presentation**

It has been identified during the HSE's report, that the use of steel O, D, or triangle rings must be used at the end of ropes attached to additional anchor points. This is to prevent the rope becoming damaged and weakened when fastened to the ground peg.