

# **Guide to Safety at Sports Grounds**

## **Worked Example C: Racecourse**

## Worked Example C: Racecourse

### Introduction

A long established, principal objective of the *Guide to Safety at Sports Grounds* is to provide guidance on the calculation of how many people can be safely accommodated within a ground while it is hosting an event, sporting or otherwise.

**Such a calculation is the most important step towards the achievement of reasonable safety.**

This Worked Example shows the capacity calculations for a small racecourse and should be read in conjunction with **Chapter 2** and **Figures 1** and **2** of the *Guide* and the [Racecourse Association's Guide to Safety at Racecourses](#).

It is recognised that capacity calculations can be presented in different formats, for example as spreadsheets, and that racecourse layouts vary considerably. However all the steps identified here must nevertheless be followed.

Further guidance on capacity calculations can be found on the SGSA website in the form of Worked Example A, for a football or rugby ground, and Worked Example B, for a cricket ground, together with Annex A on the assessment of the (P) factors and Annex B on the assessment of (S) factors.

Both the *Guide to Safety at Sports Grounds* and this Worked Example are compiled and published by the Sports Grounds Safety Authority, Fleetbank House, 2-6 Salisbury Square, London EC4Y 8JX

[www.sgsa.org.uk](http://www.sgsa.org.uk)

© Sports Grounds Safety Authority 2018 All rights reserved

## WEC.1 Introduction

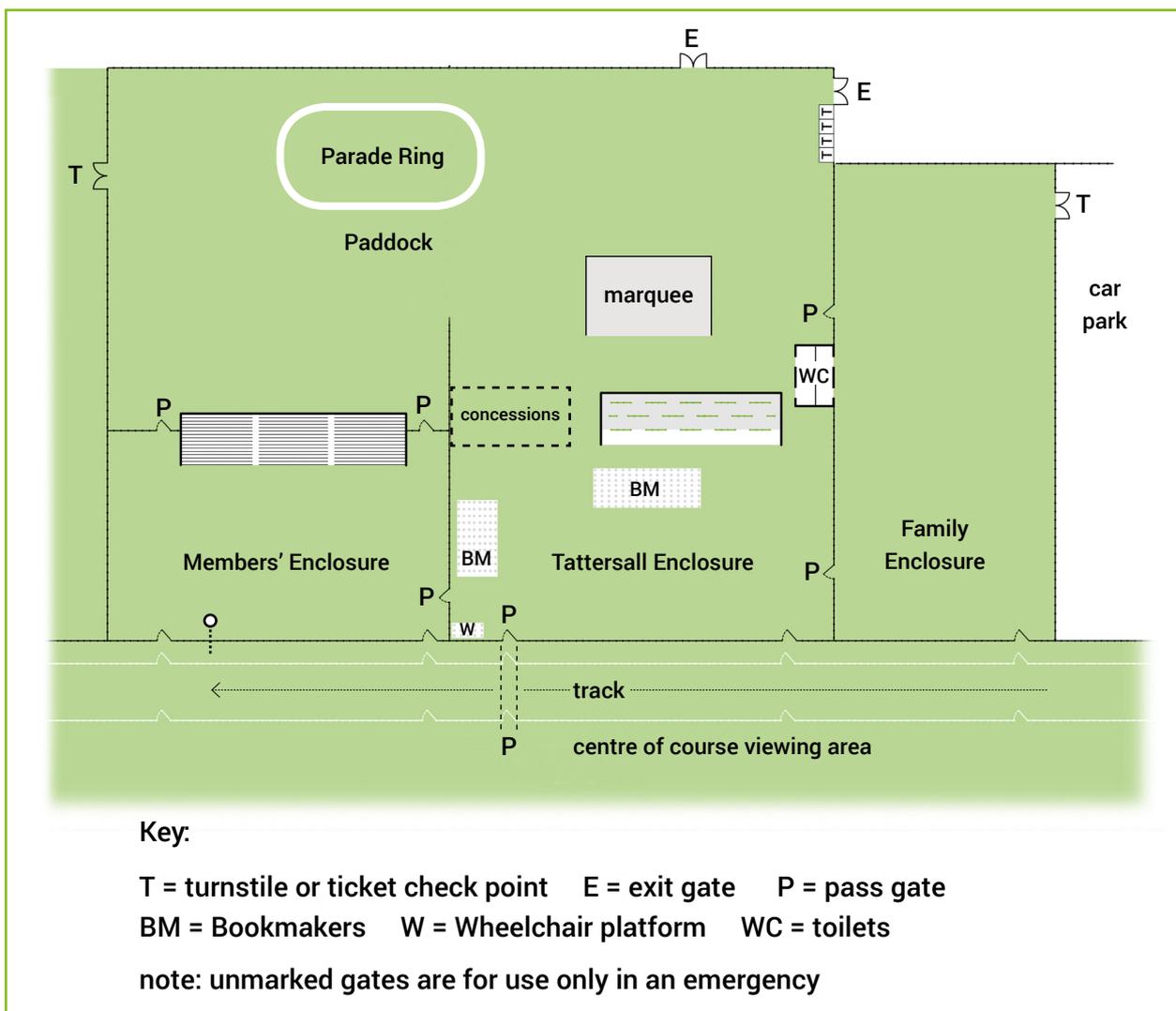
This example shows a typical small racecourse which has three enclosures, each ticketed separately. The calculations that follow relate solely to the **Tattersall Enclosure**.

As illustrated below, this enclosure consists of a lawn area extending to the track, with a covered terrace that houses a betting hall underneath, a marquee, a toilet block, an outdoor concessions area, and two areas set aside for the use of bookmakers.

Spectators entering the Tattersall Enclosure can circulate freely within the enclosure, and also access the Paddock and Parade Ring, the Family Enclosure and the centre of the course, via the pass gates shown. However their tickets do not allow them entry to the Members Enclosure or Stand. Similarly, ticket holders to the Family Enclosure cannot enter either the Tattersall or the Members' Enclosures.

The calculations that follow are based upon the stages outlined in Chapter Two of the *Guide to Safety at Sports Grounds*. The step numbers cited correspond with the steps set out in **Figure 2** (standing accommodation). The additional steps specific to racecourses are as described in the *RCA Guide to Safety at Racecourses*.

Note that to arrive at a final capacity for all parts of the racecourse it would be necessary to make similar calculations for the two adjoining enclosures.



## WEC.2 Calculate the holding capacity of the Tattersall Enclosure terrace

### a. Step 1 – calculate the available viewing area

This step is explained in Section 2.8 and Figures 2 and 15 in the *Guide*.

The total area of the Tattersall Enclosure terrace measures 36m x 8m. There are three rows of crush barriers in a staggered configuration, with no designated gangways. All crush barriers have been tested to 3.0 kN/m. The risers and goings of the terrace steps measure 140mm and 400mm respectively, forming an angle of 19 degrees. The terrace has no restricted views of the finishing straight.

**First row of crush barriers:** the depth of terracing between the front row of crush barriers and the second (or middle) row is 2.0m. This complies with the required distance for barriers of 3.0 kN/m on a terrace with a slope of 20 degrees (as set out in Figure 15 of the *Guide*).

There are five crush barriers on the first row, each measuring 4.2m in length.

Therefore the available viewing area for the terracing behind the first row of crush barriers is:  $(5 \times 4.2) \times 2.0 = 42$  square metres

**Second row of crush barriers:** the depth of terracing between the second row of crush barriers and the third (or rearmost) row is also 2.0m.

There are six crush barriers on the second row, four of which measure 4.2m in length and two of which measure 2.1m in length.

Therefore the available viewing area for the terracing behind the second row of crush barriers is:  $(4 \times 4.2) + (2 \times 2.1) \times 2.0 = 42$  square metres

**Third row of crush barriers:** the depth of terracing between the third row of crush barriers and the back wall of the terrace is also 2.0 m.

There are five crush barriers on the third row, each measuring 4.2m in length.

Therefore the available viewing area for the terracing behind the third row of crush barriers is:  $(5 \times 4.2) \times 2.0 = 42$  square metres

Section 2.8.d of the *Guide* states that if the crush barriers are staggered (rather than being continuous between gangways), and there are no clearly marked gangways, further areas must be discounted, calculated on the basis of how much space – measured at 1.2m in width – the required number of gangways would take up, if provided. However Section 13.5.b of the *Guide* also states that all spectators in standing areas should be within 12m of a gangway or exit.

As the Tattersall Enclosure terrace measures 8m deep, all spectators on the terrace are within this minimum distance, and therefore no deduction need be made for notional gangways.

**Front row of terracing:** between the first row of crush barriers and the lawn there is further terracing measuring 2.0m in depth. Although in practice spectators will stand on this terracing, because there are no crush barriers it cannot be included in the capacity calculations.

Therefore the total available viewing area for the Tattersall Enclosure terrace is:

$42 \times 3 = 126$  square metres

**b. Step 2 – calculate the appropriate density**

This step is explained in Section 2.9 and **Figure 2** in the *Guide*.

The Tattersall Enclosure terrace is in good condition and there no sightline problems. In accordance with the RCA's recommendations for the provision of 'comfortable' capacities, the racecourse management consider an appropriate density for the terrace is 4.4 spectators per square metre (that is, below the maximum recommended density for standing areas of 4.7 spectators per square metre). The management has also assessed both the (P) and (S) factors for the terrace as 1.0.

Therefore the appropriate density for the terrace is:  $4.4 \times 1.0 = 4.4$  spectators per sq m.

**c. Step 3 – calculate the holding capacity**

This step is explained in Section 2.10 and **Figure 2** in the *Guide*.

The holding capacity of the Tattersall Enclosure terrace is:  $126 \times 4.4 = 554$

### **WEC.3 Calculate the holding capacity of the Tattersall Enclosure lawn**

**a. Step 1 – calculate the available viewing area**

This step is explained in Section 2.8 and **Figures 2 and 15** in the *Guide*.

The total area of the lawn measures  $75\text{m} \times 40\text{m} = 3000\text{m}^2$

However, the following deductions should be made.

2 x bookmakers' areas:	300m <sup>2</sup>
platform for wheelchair users:	30m <sup>2</sup>
notional circulation route for ambulance (75m x 5m):	375m <sup>2</sup>
total deduction:	705m <sup>2</sup>

Therefore available viewing area is:  $3000 - 705 = 2295\text{m}^2$

**b. Step 2 – calculate the appropriate density**

This step is explained in Section 2.9 and **Figure 2** in the *Guide*.

Section 2.8.h of the *Guide* recognises that on racecourse lawns spectators are able to move freely and will spread out, and that therefore the restrictions that apply to other standing areas of sports grounds without crush barriers need not apply. That is, the available viewing area may extend to all those parts of the lawn from which viewing is possible, provided that, in order to allow for circulation, either a reduced (P) factor, or, as recommended in the *RCA Guide*, a lower, more 'comfortable' appropriate density, is applied.

In this instance, from observation and experience over a three year period the management has determined that an appropriate density of 3.2 spectators per square metre is 'comfortable' for the short periods preceding and during a race. Given this reduced density and as a result of subsequent observation, the management is also able to assess both the (P) and (S) factors for the lawn area as 1.0.

Therefore the appropriate density for the lawn is  $3.2 \times 1.0 = 3.2$  spectators per sq m.

**c. Step 3 – calculate the holding capacity**

This step is explained in Section 2.10 and **Figure 2** in the *Guide*.

The holding capacity of the Tattersall Enclosure lawn is:  $2295 \times 3.2 = 7344$

## WEC.4 Calculate provisional holding capacity of Tattersall Enclosure

The provisional holding capacity of the whole Tattersall Enclosure is therefore:

Terrace:	554
Lawn:	7344
Total:	7898

However, further calculations must still be made before setting the final capacity.

## WEC.5 Calculate the 'under-cover' capacity of the Tattersall Enclosure

Section 12.7 of *Guide* recommends that at sports grounds where the spectator accommodation offers only partial shelter, management should take measures to prevent overcrowding in wet weather. Again at racecourses these measures will differ from those required at other sports grounds, because racegoers generally have more freedom to circulate and choose their viewing positions, and usually more options for finding shelter. In addition, races are of a short duration, and spectators are more accustomed to following the action on screens or monitors in covered areas.

Owing to these factors, it is recommended that the management of racecourses calculate the capacity of *all* covered areas of spectator accommodation and ensure that, by monitoring and stewarding, these areas do not become overcrowded in wet weather.

For the Tattersall Enclosure in this example the following calculations apply.

### a. Step 1 – calculate the available viewing area of the covered areas

**Terrace:** a roof covers the rear 6m; that is, the three rows with crush barriers which, as calculated previously, offer an available viewing area of 126 square metres. (Note that although in practice the roof covers an area of 36m x 6m = 216 square metres, only the available viewing area should be used for the purposes of this calculation.)

**Betting Hall** (underneath the terrace): as explained in Section 9.4 of the *Guide*, the total floor area available for spectators to mill, queue and circulate in concourses and areas such as this, should exclude vomitories and entrances to vomitories, landings and stairs, toilets and any fixtures, kiosks or temporary installations. In the betting hall the total area available for spectators is 216 square metres.

**Marquee:** taking into account the deductions listed above, the total available area available in the marquee for spectators is 270 square metres.

### b. Step 2 – calculate the appropriate density for the covered areas

Based on risk assessment and observation, the management has assessed the appropriate density for each area as follows:

**Terrace:** 4.4 spectators per square metre (as per WEC.2.b)

**Betting hall and marquee:** 3.3 spectators per square metre

Note these densities are explained further in **Figure 11** of *Guide*.

In all three areas the management has assessed both (P) and (S) factors as 1.0.

**c. Step 3 – calculate the ‘under-cover’ capacity of the whole enclosure**

Terrace: 126 x 4.4 =	<b>554</b>
Betting hall: 216 x 3.3 =	<b>712</b>
Marquee: 270 x 3.3 =	<b>891</b>
total:	<b>2157</b>

From observation and experience, the management have further ascertained that during periods of wet weather 60 per cent of spectators typically seek shelter.

Therefore the total ‘under-cover’ capacity of the Tattersall Enclosure is:

$$\frac{2157}{0.6} = \mathbf{3595}$$

## **WEC.6 Calculate the capacity allowing for spectator flow between areas**

As stated in Sections 13.16 and 13.17 of the *Guide*, where the free movement of spectators is to be allowed between an area of spectator accommodation and another area not used for viewing – in this example the paddock and parade ring – the management should ensure that appropriate measures are taken to control the flow of spectators to ensure that the capacity of each area is not exceeded.

As shown on the plan, in the Tattersall Enclosure there are two circulation routes linking the terrace and lawn with the area behind (where the marquee, paddock and parade ring are located). Between the terrace and the concessions area is a gap measuring 5m wide. Between the terrace and the toilet block is another gap, measuring 2m wide.

Over a period of three years the management has observed and monitored the flow of spectators between the areas and noted that between races the flow is predominantly one directional at any one time.

All circulation routes are level, and therefore as recommended in Section 10.10 of the *Guide*, a flow rate of 82 persons per metre width per minute is appropriate for the purposes of calculation. It is also recommended that the calculation be based on a time period of eight minutes.

For the purpose of calculation, therefore, the maximum number of spectators that can flow between the front area of the Tattersall Enclosure and the rear area is:

$$(5 + 2) \times 82 \times 8 = 4592$$

However from observation and experience, the management have further ascertained that 10 per cent of spectators typically remain on the covered terrace or in the lawn area between races.

Therefore the capacity of the Tattersall Enclosure allowing for the flow of spectators between the front and rear of the enclosure is:

$$\frac{4592}{0.9} = \mathbf{5102}$$

## WEC.7 Determine final holding capacity

The final holding capacity of the Tattersall's Enclosure will be lowest of the three holding capacities so far calculated:

Provisional holding capacity based on static calculations (see WEC.4):	<b>7898</b>
Under cover holding capacity (see WEC.5):	<b>3595</b>
Capacity allowing for spectator flow between areas (see WEC.6):	<b>5102</b>
Therefore the final holding capacity of the Tattersall enclosure =	<b>3595</b>

## WEC.8 Calculate entry capacity

This step is explained in Sections 2.11, 7.5 and **Figures 1** and **2** in the *Guide*.

From observations and taking into account security screening, the management consider that the various turnstiles and entry points are able to process 550 persons per hour.

### a. Daytime meetings

For daytime meetings an entry period of 2.5 hours (from 10.30am – 1.00pm) is deemed sufficient for the Tattersall Enclosure, using three of the four turnstiles shown on the plan.

Therefore for daytime meetings the entry capacity is:  $3 \times 2.5 \times 550 = 4125$

### a. Evening meetings

For evening meetings, when attendances are normally lower, an entry period of 1.5 hours (from 5.00 – 6.30pm) is deemed sufficient for the Tattersall Enclosure.

However, the fourth turnstile is brought into use.

Therefore for evening meetings the entry capacity is:  $4 \times 1.5 \times 550 = 3300$

## WEC.9 Calculate the exit capacity

This step is explained in Section 10.9 – 10.11 and **Figures 1, 2** and **13** in the *Guide*.

As stated in Section 10.11 of the *Guide*, under normal conditions it should be possible for all spectators to leave their place in the viewing accommodation and enter into a free flowing exit route **within eight minutes**. This time may be referred to as the 'Zone 2 travel time' (Zone 2 being the viewing accommodation). As explained in **Figure 13**, under normal conditions there is no need to measure how long it might take spectators to negotiate the entire exit route.

The exit routes in the Tattersall Enclosure start where the gaps are on either side of the Terrace, both leading to the paddock area and the exits beyond.

As stated earlier these gaps measure 5m and 2m wide respectively.

Once again a flow rate of 82 people per metre width per minute should be used for the purpose of calculation.

The exit capacity of the Tattersall Enclosure is therefore  $(5 + 2) \times 82 \times 8 = 4592$

## WEC.10 Calculate the emergency exit capacity

This step is explained in Sections 2.13, 10.12 – 10.18, 15.9 and **Figures 1, 2 and 13** in the *Guide*.

There are two exit gates used for emergencies at the rear of the Tattersall Enclosure, each measuring 3.0m in width. All emergency exit routes are level, and therefore for the purposes of calculation, a flow rate of 82 people per metre width per minute should be applied.

Being in the open air, all emergency exit routes should also be considered as low risk. Therefore for the purpose of calculation a maximum emergency egress time of **eight minutes** should be applied.

Should an incident occur in the centre of the course, requiring an emergency evacuation to the rear of the Tattersall Enclosure, the emergency exit capacity is therefore:

$$(3.0 \times 2) \times 82 \times 8 = \mathbf{3936}$$

Note however that as stated in Section 2.13 of the *Guide*, the emergency exit capacity must include not only spectators but *all* people present. In the Tattersall Enclosure this would include not only spectators, but all staff and bookmakers.

An assessment confirms that these make up 5 per cent of the total (or approximately 196 people). Therefore the emergency exit capacity of the Tattersall Enclosure, for spectators only, is  $3936 - 196 = \mathbf{3740}$

## WEC.11 Calculate the final capacity of the Tattersall enclosure

The final capacity of the Tattersall Enclosure is the lowest figure of those calculated, as follows:

Final holding capacity (see WEC.7):	<b>3595</b>
Entry capacity daytime (see WEC.8.a):	<b>4125</b>
Entry capacity evening (see WEC.8.b):	<b>3300</b>
Exit capacity (see WEC.9):	<b>4592</b>
Emergency exit capacity (see WEC.10):	<b>3740</b>

Therefore the final capacity of the enclosure = **3595** (daytime) and **3300** (evening)

## WEC.12 Planning for exceptional egress

As recommended in the *Guide* and the *RCA Guide*, the management of the racecourse have in place various contingency plans, including for the exceptional egress of spectators.

Exceptional egress, or evacuation, is defined as egress from, or movement within a sports ground which, in response to exceptional circumstances – such as a terrorist threat or attack, occurring either inside or outside the ground – may require procedures other than those put in place for normal or emergency egress.

One contingency plan is to evacuate spectators from the Tattersall Enclosure, and the two other enclosures, to the centre of the course, either at the same time or in a pre-determined order.

Evacuation from the Tattersalls Enclosure to the centre of the course is via two 3m wide gates in the front rail, as shown on the plan.

As detailed in Section WEC.10 above, based on a flow rate of 82 people per metre width per minute, these emergency exits would allow 3936 people to evacuate to the centre of the course in eight minutes; that is  $(3.0 \times 2) \times 82 \times 8$ .

As 3936 exceeds the final capacity of the enclosure (both for daytime and evening meetings) this exceptional egress capacity is sufficient.

If the Members Enclosure has greater crowd numbers than Tattersalls, those evacuating from the Members Enclosure can be directed by stewards to use the pass gate into Tattersalls, and similarly from Tattersalls into the Family Enclosure, thereby increasing the number of available gates to 5 in total.

Each of these pass gates measures 3 metres and therefore the total exceptional egress capacity of the racecourse to the centre of the course in eight minutes is:

$$(5 \times 3) \times 8 \times 82 = \mathbf{9840}$$

Once again, as it is calculated that staff, bookmakers and other personnel other than spectators make up 5 per cent of the total (or approximately 492 people), this means that the overall exceptional exit capacity of the racecourse is:  $9840 - 492 = \mathbf{9348 \text{ spectators}}$ .

Note that on large racecourses where the enclosures are longer and the crowd may therefore be further from the location of an incident, an extended evacuation time may be considered appropriate, for example of up to 15 minutes.