

Gary Masters
April 2007

JCSSM
1, 1

35

Abstract

Although, the ingress phase is widely regarded as one of the higher risk elements of an event, knowledge concerning ingress flow rates is limited. This study looks at the ingress flow at eleven different events at the NEC arena, and the impact of: audience age profile, start time and support acts, and alcohol consumption, on ingress flow. A quantitative design approach was used to capture data on ingress flow. This exploratory study shows that the peak ingress flow rates achieved at these events varied greatly. The start time of the main artiste clearly had a major bearing on ingress rate. There was some indication that alcohol spend was higher where the audience profile was younger. There was no evidence that the audience age profile had any bearing on ingress flow. All these tentative findings require further research to understand more fully the factors influencing ingress flow at events.

Introduction

Available guidance concerning ingress flow rates, the rate at which visitors can be processed and admitted to a venue, is very limited. Yet the ingress phase of an event is widely regarded as one of the higher risk elements of an event. This is supported by historical records concerning crowd safety disasters which indicate the loss of 34 lives over the last 30 years during the ingress phase of events (BCUC 2006).

The NEC Arena has been operating successfully for many years, experiencing few ingress related problems. Whilst current arrangements clearly work, research has never been undertaken to identify the flow rates being achieved.

Beside ticket checking, other factors which may impact ingress flow rates include: rate and time of arrival and bag or body searches. As all target events had similar search requirements, this factor did not influence the data captured for this study. The impact of higher search requirement on peak flow rate thus remains an area for further research.

There is conflicting information concerning ingress flow rates in widely used published guides. The guide to safety at sports grounds, also known as the green guide (DCMS, 1977), identifies a maximum turnstile ingress rate of 660 people per hour. A comparative study of crowd behaviour at two major events suggests achievable rates of 1200 per hour (Kemp, Hill & Upton, 2004). The latter is based on an estimate using single file flow rates stipulated in a Home Office (1990) 'guide to fire precautions in existing places of entertainment and like premises', also known as the 'yellow guide'. The guide actually suggests 2400 people per hour through a unit width of 525mm, but this figure was halved by Kemp et al to allow for ticket checks and searches.



Journal of Crowd
Safety and Security
Management
An online journal

Audience profiles are used to categorise the type of people expected to attend a particular event, and to plan various aspects of the event including: stewarding and security staffing numbers, the number and type of catering units required, the number of car parks needed and the level of medical provision. An Audience profile is generally made up of a combination of factors, however, most relevant profile factors for genre or event type classification are age and gender. The importance of establishing and planning for the expected audience profile is thus seen as extremely important (HSE, 2000).

This study looks into whether the audience profile of a particular event influences ingress flow rates, arrival at the venue, alcohol consumption and need for medical attention. Previous research suggests that genre and audience profile can influence the level of spend on alcohol (White, 2001). Furthermore, a University of Illinois study (year) into 300 medical incidents at outdoor concerts in Chicago, found that 48% of those being treated had taken alcohol or drugs. Alcohol was the most common substance used by concert spectators and was documented in 36% of all patients (Reuters, 2007). This study explores this relationship at the NEC Arena.

Study Method

Capturing data on ingress flow rates lends itself to a quantitative design approach. This allowed a focused collection of large quantities of data, over a sustained period time. Data was captured from eleven concerts taking place at the NEC Arena between November 2006 and February 2007 (see table below).

Concert	Date
Pink	29-Nov-2006
Pussycat Dolls	30-Nov-2006
Iron Maiden	12-Dec-2006
Tenacious	15-Dec-2006
Kasabian	14-Dec-2006
Rock With Laughter	22-Dec-2006
Rock With Laughter 2	23-Dec-2006
Nelly Furtado	20-Feb-2007
Keane	23-Feb-2007
X Factor	25-Feb-2007
X Factor 2	26-Feb-2007



In capturing the data, stewards were deployed at each of the three main entry points to the Arena. They were provided with hand tally counters to count the number of people entering the venue at each point. At fifteen-minute intervals the control room operator contacted the entry point and requested a tally counter reading. These readings were recorded by the control room operator on an Excel spreadsheet created for this purpose.

The number of entry lanes in operation at each entry point was also recorded to establish an average lane reading. The same spreadsheet is used to input data from all the other concerts so that comparative analysis can be accomplished accurately and more productively.

JCSSM
1, 1

37

The following data was also obtained for each event from venue departments and teams: pre-event evaluation of expected audience profile and type of artiste and performance, statistical data concerning total spend on alcohol, number of cars parked, number of people who required medical attention, and final ticket sales numbers. In the Nelly Furtado concert, the venue was also trying a new bar code ticket scanning system, which provided the opportunity of comparison with the data captured by stewards using hand tally counters.

Access to data was facilitated by existing contacts at the Arenas. The ethics which guided this study centred on obtaining informed consent. The project was discussed with senior managers of key business areas and they agreed to supply the required information. It was agreed that information of commercially sensitive nature would not be widely published, and that copies of the final report provided to the venue.

Findings

Ingress Flow Rates

As expected ingress rates differed by event. The data captured by the hand tally counters enabled the calculation of average ingress flow rates, per lane, per fifteen-minutes and per hour. The highest ingress flow rate achieved was an average 932 per hour, per lane during the period of 1830 hours and 1930hrs at the 'Rock with Laughter' Concert on 23 December 2006. The green guide (DCMS, 1997) suggests that the ingress flow rate per turnstile should be set at a maximum of 660 people per hour.

The average peak flow rate achieved over the eleven concerts was 742 people per hour, per lane. This figure would have been higher if it was not for the low visitor numbers attending Nelly Furtado's concert. The ingress flow figures of 932 and 742 are lower than both The Home Office (1990) guide of 2400 people and Kemp et al's (2004) figure of 1200 but higher than green guide of 660 people.

Increased searching requirements would slow the rate down closer to the green guide rate of 660 people per hour, while the deployment of additional staff at ingress lanes, might increase the rate towards Kemp's et al.'s (2004) 1200 figure. Evidently further research is required.

Audience Profile

At the outset, it was decided that the issue of gender was not relevant to this research; however, age was given a prime consideration. However, correlation analysis shows no association between the age profile of the audience and the peak rates achieved, and no



Journal of Crowd
Safety and Security
Management
An online journal

association between the type of band, artiste or music and flow rates. This suggests that the ingress flow rate is largely influenced by the venue's ingress and admission processes, and that rates of passage are determined by the efficiency and constraints of these processes.

Start Time and Support Acts

What the analysis also indicates is that other factors may have influenced the achievable rates. The start time of certain events is an important factor, particularly when there is no support act and the main artiste is on stage at the beginning of the event. This study indicates that the two highest flow rates were achieved on high attendance shows where both had early main act start time and no support act. The following graph (Figure 1) shows the phasing of audience admission, for 'Rock with Laughter' event where there was no support act, and the show started much earlier in the evening. As such the ingress is achieved over a much shorter period as shown by the steeper curve and much earlier tail off.

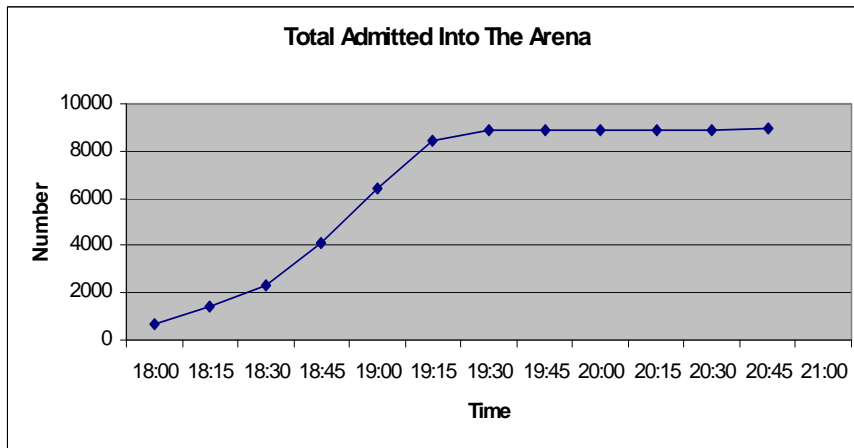


Figure 1 Rock with Laughter

Where there is a support act, some people may not be interested in the act and do not tend to arrive early, spreading the ingress over a longer period. This is demonstrated by the graph in Figure 2 for the 'Pink' show where there was a support act and the main artiste was not on stage until much later. Here, the graph is less steep and the tail-off is much later than that of 'Rock with Laughter', indicating that the number of people admitted into the arena was spread over a longer ingress period.

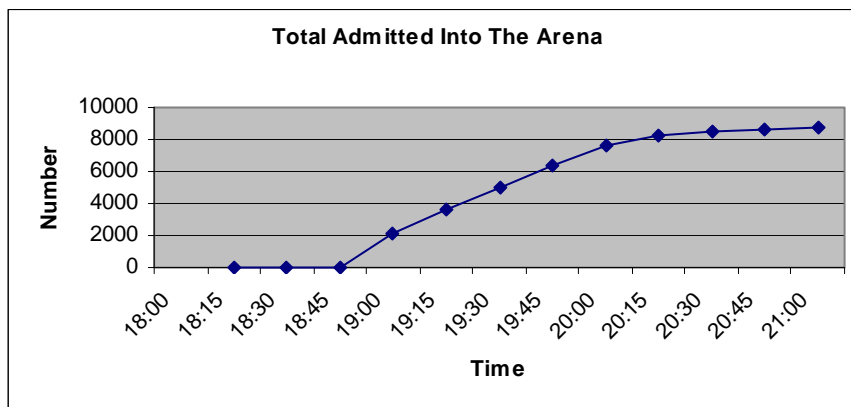


Figure 2 Pink

Data Capture Accuracy

The accuracy of the data capture using the hand held tally counters has become a concern. During the 'Nelly Furtado' event a new ticket scanning system was tested, providing the opportunity to compare data accuracy. Whilst some inaccuracy was anticipated, significant discrepancies were detected between the hand held tally counters and the ticket scanning system, which would clearly impact the resulting flow rates. These discrepancies may be attributed to a number of causes, all of which require further research, such as: inaccurate data capture or data input, timing, delay in taking readings or inaccuracy of over clicking.

It should also be noted that the total admission figures from the data



captured for the ingress will differ from the final figures provided by the box office. This is because early admissions are permitted into the bar, self-service restaurant and hospitality dining area. These numbers were not recorded.

Alcohol Consumption

Using the total attendance figures for each show supplied by the box office, an average spend per head was calculated and examined for links to audience age profile or event genre. Analysis of the data shows only a slight bias toward a younger audience drinking more alcohol; three of the top five highest spends per head, occurred when the majority of the audience was under 25 years of age (at 'Pink', 'Nelly Furtado' and 'Pussycat Dolls'). It should be noted, however, that both 'Pink' and 'Pussycat Dolls' respectively had 30% and 40% of the audience under 21 and 10% under 16 years of age; and Pussycat dolls a further 10% under 10 years. This clearly influenced spend per head as alcohol sales are restricted to over 18's only. 'X factor' also had a large percentage of under 18's, and reflected in the level of spend per head. As a result, it was not possible to establish a definite link between the age profile of the audience and the level of spend per head, or the type of event and the level of spend per head. Further research is therefore required which will have to exclude the under 18 years of age.

In contrast, the link between artiste genre and the level of spend per head on alcohol was stronger. The two highest spends per head were experienced at indie / guitar concerts and the next two highest spends were at traditional rock type concerts. This finding seems to support White's (2001) report which identified that rock concert goers drank more alcohol than attendees at other concerts (indie / guitar bands are a modern form of rock).

Conclusion

The peak ingress flow rates achieved at these differing events varied greatly. The start time of the main artiste clearly had a major bearing on the arrival and ingress rate achieved. It is not evident from this research that the audience age profile has any bearing over the ingress flow rates.

The maximum flow rates per lane, 932 and 742 (average) people, at peak are significantly higher than the 660 people per lane of the green guide and lower than Kemp et al's (2004) 1200. The method used for capturing the ingress flow rates may have led to some inaccuracies. In hindsight a more concentrated approach with stewards capturing data from a single entry lane, would have been preferable to the approach applied during this research, where a single steward was covering up to three lanes. At peak in a busy environment this might have affected accuracy.

The research concerning the alcohol spend per head in relation to audience profile, did not provide any conclusive outcome.



Whilst there was some indication that the level of spend appeared to be higher where the audience profile was younger, this would require further research to capture the age of individuals attending the event in order to discount those under the age of 18.

JCSSM
1, 1

The research also did not find any direct relationship between the level of alcohol spend per head and the number of people attending the medical centre for treatment. Again further research may provide useful information in this area. Capturing the specific reason for attending and then clustering them by category is essential. These categories can then be compared with the alcohol spend, age and type of event. This may provide more direct relationships or correlations.

41

References

- BCUC. (2006) Crowd safety by design module, unit 5. *The concepts and categories of risk* [online] BCUC. Available from: http://blackboard.bcuc.ac.uk/webapps/portal/frameset.jsp?tab=courses&url=/bin/common/course.pl?course_id=_122619_1 [Accessed 16 February 2007].
- DCMS. (1997) *Guide to safety at sports grounds*. 4th ed. Norwich: HMSO.
- DCMS. (1997) *Guide to safety at sports grounds*. 4th ed. Norwich: HMSO.
- HSE. (1999) *The event safety guide: a guide to health, safety and welfare at music and similar events*. 2nd ed. Norwich: HMSO.
- HSE. (2000) *Managing crowds safely*. 2nd ed. Norwich: HMSO.
- Kemp, C. Hill, I. and Upton, M. (2004) *A comparative study of crowd behaviour at two major music events*. Cambridge: Entertainment Technology Press.
- Reuters (2007) *Drugs, alcohol and injury at rock concerts*. [online] Available from: <http://www.personalmd.com/news/a1996070104.shtml> [Accessed 8 May 2007].
- Robson, C. (2002) *Real world research*. 2nd ed. Oxford: Blackwell
- White, L. (2001) *The relationship between alcohol consumption and the type of music*. [online] Available from: <http://clearinghouse.missouriwestern.edu/manuscripts/253.asp> [Accessed 8 May 2007].



Journal of Crowd
Safety and Security
Management
An online journal