

PED 2010

HUMAN INTERACTIONS LIMITED

Human Factors & Crowd Safety Specialist

ASSESSING CROWD DYNAMICS & SPECTATOR SAFETY IN SEATED AREAS AT A FOOTBALL* STADIUM

* Soccer

S Y Zachary Au PhD
Human Interactions Limited, UK

Jenny Gilroy
Atkins, UK

Prof. Roger A Haslam
Loughborough University, UK

Corresponding author: zac.au@human-interactions.co.uk





Capacity = 76,000 (68,000)

OBJECTIVES

- To assess the safety risk associated with spectator standing.
- To assess the adequacy of the existing provisions.
- To propose additional safety measures where appropriate.

Three types of standing: (a) persistent standing, (b) standing at moments of excitement, (c) “standing” on entering/leaving seated areas.



RISK INFORMATION

Risk = Likelihood/frequency of a hazardous event x Consequence

- Hazards
 - Likelihood / Frequency
 - Consequence & Severity
 - Causes and risk factors
- 

WHERE & HOW TO OBTAIN RISK INFORMATION?

Post Match Reports:

- A record of key events and facts & figures in each match.
- Provide historical record over a period of time.
- Enable identification of trends and relationships between standing and other factors.

Research



Records & statistics
(review post match reports)

WHERE & HOW TO OBTAIN RISK INFORMATION?

Stakeholders:

- Experts in their domains.
- Cover different angles and perspectives.
- But information can be subjective.

Staff & Spectators:

- Frequently attended matches.
- Considerable knowledge of what actually happen on the ground.



QUESTIONNAIRE SURVEY

	Never	Once or twice/season	Several times/season	Almost every match
Persistence standing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Moments of high excitement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Entering/leaving seated areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- Also invite additional comments.
- Good for:
 - Quantifiable information.
 - Provide further insight into the causes of standing and the risk factors.

WHERE & HOW TO OBTAIN RISK INFORMATION?

Examination of physical design
(Ergonomics assessment)

Examination of crowd activities & behaviours
(observations)

Staff & Spectators
(questionnaire survey)

Research

Risk Information

Observations:

- Study movements & behaviors in detail.
- Identifying hazardous behavior and how they could cause harm.

Ergonomics Assessment:

- Examine key dimensions against anthropometry data and movements & behaviors.
- How physical design may contribute to risk.

RISK ASSESSMENT

1. Post match reports

2. Consultation

3. Observations

4. Questionnaire survey

5. Ergonomics assessment

1

2

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1

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4

5

Identify Hazards

Identify Causes & Consequences

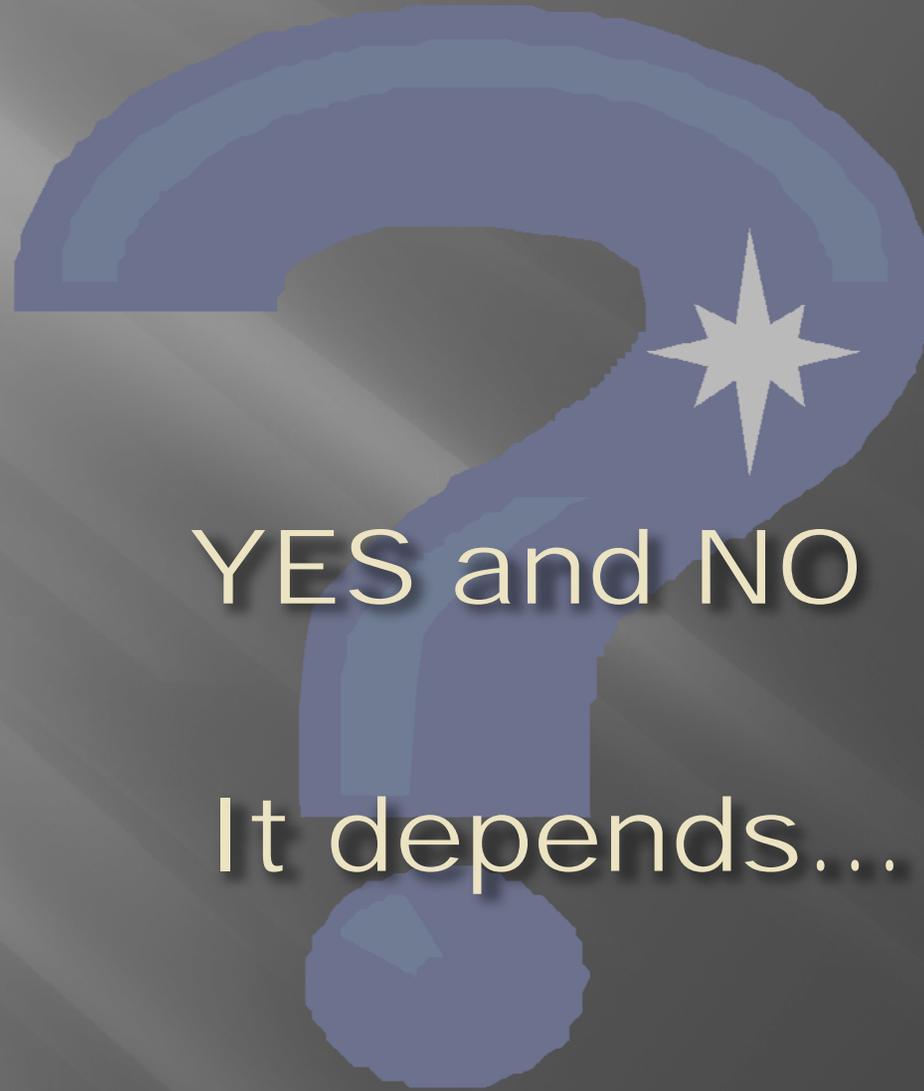
Identify Existing Precautions

Evaluate Risks



IS STANDING UNSAFE?





YES and NO

It depends...



IS STANDING “RISKY”?

- The risk cannot be generalized.
 - 3 main risk factors:
 - Movements
 - Behaviors
 - Physical design
- 

MOVEMENTS

	Never	Once or twice/season	Several times/season	Almost every match
Persistence standing	83.8%	12.8%	2.7%	0.7%
Moments of high excitement	44.4%	34.3%	15.3%	6%
Entering/leaving seated areas	55.2%	30.6%	12.5%	1.7%

- Risks depend on amount and types of movement.
- Types of movements:
 - Standing relatively still.
 - Jumping upward & forwards at the same time; jumping with both feet off the ground; vigorous upper body movements when jumping; and jumping and swaying as a group.
 - Passing other people, leaning forward and backward.

BEHAVIORS

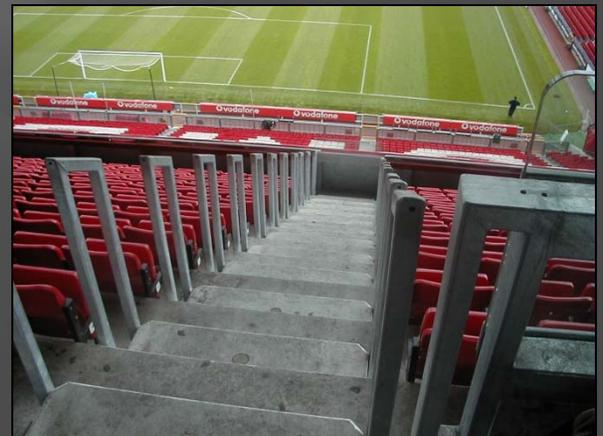
- Pose additional hazards and risks.
- “Consequential” hazards from persistent standing:
 - Standing close to front edge.
 - Children standing on seats.
 - Sitting on seat backs.
 - Intoxication.

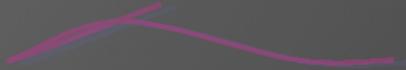
BEHAVIORS

- Other behavioral hazards:
 - Leaning over front barriers at moments of excitement.
 - Looking elsewhere when entering/leaving seated areas.
 - Carrying large items.
 - People with hot drinks.

SEATED AREA DESIGN

- Clearway
- Seat size
- Front barriers





SUMMARY OF FINDINGS

- Risks vary from scenario to scenario and from location to location.
 - Main risk factors: movements, behaviors and physical design
 - Moments of Excitement > Entering/Leaving seated area > Persistent Standing.
 - Upper tiers (Tiers 2 & 3) > Lower tiers.
 - Front of upper tiers poses a even higher risk.
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CONCLUSIONS

- Understanding movements and behaviors is key to risk management.
 - Stadium design required further consideration.
 - Scope for expanding the study into a more generic context of stadium design.
 - Information gathering was the main challenge; a similar study method could also be used in comparable contexts.
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THANK YOU.