Review of UK Fairgrounds Working at Heights

A Report from NEL for

Health & Safety Executive

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A Report from NEL for

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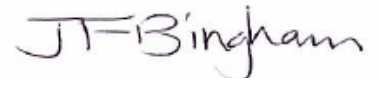

For
Michael Valente
Managing Director
Date: May 2005

EXECUTIVE SUMMARY

In 2004 NEL was contracted by the Health & Safety Executive (HSE) to undertake a review of working at heights within the UK fairground industry.

The purpose of the review was to assess practice in the industry against the new Work at Height Regulations[1] (WAHR). These regulations are intended to reduce the number of accidents and deaths caused by falls from height, which remain the single largest cause of fatalities in the workplace.

NEL visited two travelling and two fixed fairgrounds to survey a representative sample of working at height activities during the assembly, dismantling and inspection of fairground rides and entertainments.

The main conclusions from the review are:

- A large amount of working at heights within the UK fairground industry is necessary and unavoidable.

- The fairground industry often experiences additional difficulties and hazards which can increase the risks and problems encountered while working at height. These include hazards from working in outdoor environments, unsuitable ground conditions, working under pressure to extremely tight deadlines, restrictions in space and access, and at times an absence of suitable overhead structural anchor points to accommodate PPE. Any of these may limit the choice of work equipment and affect the standards of safety provided.

- Large variations existed in the levels of fall protection observed, where at times no means of fall protection were evident during working at height.

- The fairground industry relies heavily on the use of fall arrest PPE, which should be the last line of defence in the safe working at heights hierarchy. The industry is often forced to use PPE due to impracticalities in employing safer methods, design of installations and limitations of work equipment.

- The uniqueness of fairground rides and work applications often results in difficulties in sourcing suitable readily available PPE from the market.

- PPE was regularly used outside the PPE manufacturers' intended scope of application.

- Major failures in the management, organisation, planning and control of working at height activities were evident. Specific areas of weakness included:

    - Using PPE outside the intended application
    - Training and awareness
    - Inspection, care and maintenance of work equipment
    - Inspection of work place (to identify potential hazards)
    - Rescue provisions

This report makes a number of recommendations aimed at improving management procedures and the safety of workers at height.

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1 INTRODUCTION

This report presents the findings of a survey conducted during 2004 by NEL for the Health & Safety Executive (HSE) to assess working at height activities within the UK fairground industry. The findings detailed in this report collate and summarise the conclusions from four separate fairground visit reports[2,3,4,5] submitted to HSE.

Typical rides and entertainments reviewed as part of the survey are contained in Appendix I. It should be noted however that the rides shown are for the purpose of example only.

The findings of this report have also been disseminated by NEL at presentations made to the following HSE and fairground industry bodies:

- HSE NFIT Training Day (14 September 2004)
- FJAC Meeting (1 December 2004)
- British Association of Leisure Parks, Piers and Attractions (17 February 2005)

2 PURPOSE

The purpose of the survey was to assess practice in the industry against the new Work at Height Regulations (WAHR). The new WAHR will for the first time cover all industries with one single set of regulations.

Specific objectives of the project were to:

- Identify working at height activities
- Evaluate risks and control measures
- Document, report and present findings
- Provide recommendations and guidance

3 APPROACH

The approach involved a survey of two travelling and two fixed fairgrounds to provide representative samples of working at height during the assembly, inspection and dismantling activities of fairground rides and entertainments. The review covers all work activities at height where there is a need to prevent or control the risk of a worker falling a distance liable to cause personal injury.

All observations made during the survey were captured on film for information and analysis purposes using a digital video recorder and still camera. All images obtained during the survey have been given to HSE.

Due to the nature of the survey, the presence of NEL and HSE staff may have influenced the behaviour of workers, where the procedures observed during the visits may have differed from those normally used in practice.

Fairground workers and fairground management representatives were consulted at times to provide necessary information. Therefore, many of the findings from this survey rely on the accuracy of information supplied.

In assessing the methods used to protect against falls from height, consideration has also been given to provisions for evacuation in emergency situations and rescue, where the timely and safe recovery of falls victims is essential in preventing further discomfort, injury or even death.

Although the survey represents only a sample of working at height activities within the UK fairgrounds industry, the specific fairgrounds selected for review are believed to be representative.

4 TERMS AND DEFINITIONS

In this report the following terms and definitions apply.

Working platform	Platform used to provide place of work or as a means of access and egress to another place of work e.g. mobile elevated working platform, integrated elevating working platforms, suspended cradles, scaffolding.
MEWP	Mobile elevated working platform i.e. cherry picker or scissor lift.
Integrated elevating working platform	Moving part of a ride used to act as a platform for work and to provide access and egress to and from place of work e.g. passenger shuttle cab on a drop tower type ride.
Suspended cradle	A suspended working platform for personnel.
Collective fall protection	Equipment used to provide fall protection to more than one person including guardrails, safety nets and landing mats.
Guardrails	A rigid barrier used to restrict access to hazardous areas or to prevent falls from height.
Safety nets	A net used to catch a falling person.
Landing mats	Systems used to provide the worker with a soft landing in the event of a fall e.g. air bags and filled soft landing bags.
Fall protection PPE	Equipment used to protect an individual from falls, including work restraint, work positioning and fall arrest PPE.
Work restraint PPE	Equipment used to restrain the worker and prevent the accessing of hazardous areas, e.g. open edges.
Work positioning PPE	Equipment used to support the positioning of person during work activities to enable both hands free to carry out the work tasks.

Gin Wheels	Pulleys used to aid the lifting and positioning of equipment.
Ladders	All ladders, fixed and portable.
Fixed ladders	Ladders fixed rigidly and permanently to a structure.
Portable ladders	Ladders which are easily removed and temporary.
Stepladders	Folding steps.
Notified body	A body which is appointed by the DTI to undertake specific duties under the European PPE Directive PPE/89/686/EEC[6].

5 SURVEY FINDINGS AND DISCUSSION

5.1 Introduction

The fairground industry in the UK comprises a large number of travelling fairs and fixed theme parks, in addition to small-scale entertainment rides and stalls generally found in shopping centres and at fetes. The staffing of a typical fairground can comprise self-employed workers, small teams and large organisations. Much of the work is performed outdoors, often under extreme pressure to meet tight deadlines and public access ways are regularly restricted or closed during the assembly and dismantling of fairgrounds.

Working at height activities and the associated safety needs differ greatly between fixed theme parks and travelling fairgrounds. The majority of work conducted at travelling fairgrounds involves the repeated building and dismantling of rides and entertainments. This can affect the choice of work equipment, which can involve:

- Heavy transportation costs for certain equipment, e.g. MEWPs and scaffolding
- Difficulties in the installation of permanent fixtures, such as walkways and staircases
- The suitability of certain PPE systems, where installation of the PPE is required following the complete assembly of the ride

The majority of working at height activities in fixed theme parks is carried out during the inspection of rides, where rides are erected on a more permanent basis.

Some fairground rides date back to the early 1900s and are less likely to have had provisions made at the design stage to accommodate safe work methods and equipment during the build, inspection and dismantling. Each ride is unique, and even where rides appear similar, the structure and work applications can differ greatly.

Further considerations include the aesthetics and ethos of fairground rides where equipping the rides with safety nets and air bags may have a negative effect on public perception. Such safety measures may for some passengers arouse suspicion

and doubt about the safety of the ride, while for other passengers the presence of the safety nets may reduce the perceived level of danger and thrill element of the ride.

5.2 Working at Heights

A large amount of work performed during the build, dismantling and inspection of fairground rides and entertainments was carried out at height. This included work on large scale rides, work on medium and small sized frames, and general activities performed from ladders, roofs and transportation vehicles. Identification of the types of rides and entertainments reviewed during the survey is shown in Appendix 1.

The nature of work and the actual heights involved varied greatly, from working at heights around 1 m, to around 100 m. In most cases working at height appeared to be necessary and unavoidable, since for many rides it was highly impractical to build at ground level and thereafter crane into position. There were occasions when working at height could have been avoided, mainly during cleaning activities, when consideration could have been given to the use of extension poles and jet sprays.

The tasks involved and the provisions for fall protection observed during the survey varied greatly. Three regimes were evident:

- No protection against falls, where protection against falls was non-existent or methods used were inadequate

- Part protection against falls, where the worker was protected for only part of the time

- Adequate protection against falls, where suitable measures were in place to protect the worker while at height

A detailed comparison of results by ride type is included in Appendix 2.

5.3 Environmental and General Hazards

The environment and general conditions in fairgrounds can often introduce additional hazards and problems which can increase the difficulties and risks experienced when working at height. Some factors are listed below:

- In outdoor environments weather conditions can often affect the safety of workers and work equipment, which may be exposed to rain, temperature effects, wind, snow, ice, darkness and lightening strike. These can influence worker visibility, ground conditions, stability of structures, balance of workers, surface grip and the safe operation of equipment. Such hostile conditions can accelerate the corrosion of metals and degradation of textile materials used in fall protection installations and work equipment

- Frequently, fairgrounds are very compact resulting in restricted space and access, and this can often limit the selection of work equipment

- Tight deadlines can frequently affect the safety of staff working under extreme pressure and can also influence the choice of work equipment, if it is known that some work equipment may slow down the working process

- The absence of suitable structures in outdoor fairgrounds can regularly present difficulties in acquiring suitable anchor points to accommodate fall protection equipment such as safety nets and PPE

5.4 No Protection Against Falls

On a number of occasions no effective means of protection was evident to protect workers at height, even for extremely risky work at heights of over 100 m. Shortcomings included inadequate means of safe access and egress to and from the workplace, dangerous work locations, and failure to provide suitable collective protection or PPE to arrest the worker in the event of a fall.

The failure to provide workers with suitable fall protection was attributable to various reasons including:

- Lack of awareness of safety requirements
- Disregard of safety
- Difficulty or perceived difficulty in sourcing PPE
- Expense

It was observed that workers regularly failed to make use of the PPE provided to them while at height.

5.5 Working on Transportation Vehicles and Roofs

A large amount of work was carried out on top of transportation vehicles and on roofs, including the roofs and gantries of fun houses. The work was mainly carried out during the unpacking of rides, the installation of equipment and cleaning activities. Generally no barriers or restraint systems were in place to prevent workers from accessing and falling from open edges.

5.6 Methods for Access and Egress

Methods used to provide workers with a safe means of access to and egress from the place of work were often inadequate and generally included the use of ladders, walkways/stairways and climbing frames. On occasion, MEWPs, suspended cradles and integrated working platforms were used to provide access.

Poor foot-holds and hand-holds regularly prevented safe access to and egress from the place of work, a typical example of which is shown in Figures 1 and 2, where while climbing over 100 m high, the worker is forced to use the top of the ladder stile (side) to access the upper span of the ride. Such a foot-hold does not provide the foot with adequate support while climbing, and greatly increases the risk of falls occurring.

Fixed ladders used for access were frequently interrupted or obstructed by other parts, Figures 3 - 6, which prevented safe passage of the worker.

Fixed ladders of significant height regularly lacked adequate fall protection and safety provisions, including ladder hoops/cages, resting/landing platforms or suitable fall arrest systems.

Portable ladders, including stepladders, were often unsecured, rested against unstable structures and were of insufficient length, Figure 7, to provide safe access and egress.

Partly built, unstable frames, with poor foot-holds and hand-holds were frequently used by workers to facilitate access to and egress from their place of work.

Walkways and stairways often exhibited poor edge protection and gaps in flooring, which presented a risk of workers and objects falling over open edges and through floors. In some locations, however, due to the clearance requirements for moving parts of rides, genuine difficulties existed in the adequate installation of enclosures and edge protection, where the tracks of rides were frequently positioned immediately adjacent to the inner side of walkways and stairways. Figures 8 - 11 provide typical examples of inadequate walkways.

Walkway and stairway surfaces regularly lacked adequate anti-slip measures which posed a great risk to workers, especially on slopes and under wet and icy weather conditions.

Workers frequently carried large and heavy items, while climbing ladders and frames. This often increased the risk of falls occurring by reducing visibility and preventing a safe hand-hold.

At times no adequate methods or systems were in place, Figure 12, to allow the safe transfer of workers between positions, including transfer from the top of fixed ladders to adjacent work platforms.

FIGURE 1 INADEQUATE FOOT-HOLDS AND HAND-HOLDS AT OVER 100 METRES

FIGURE 2 INADEQUATE FOOT-HOLDS AND HAND-HOLDS AT OVER 100 METRES

FIGURE 3 FIXED LADDER INTERRUPTIONS/OBSTRUCTIONS

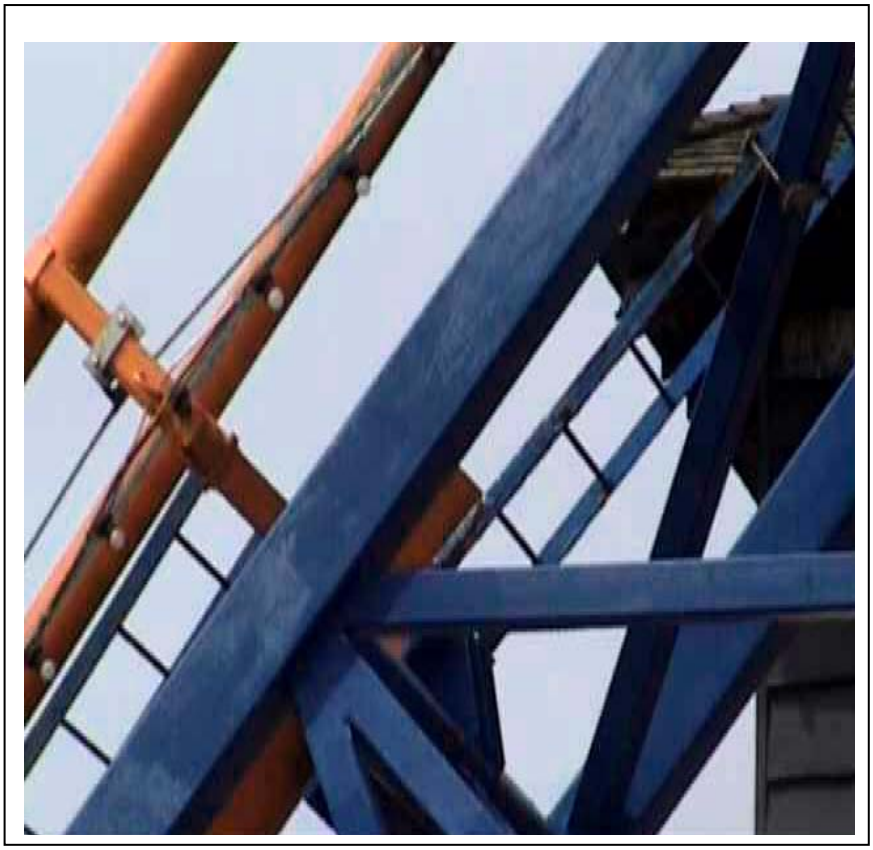

FIGURE 4 FIXED LADDER INTERRUPTIONS/OBSTRUCTIONS

FIGURE 5 FIXED LADDER INTERRUPTIONS/OBSTRUCTIONS

FIGURE 6 FIXED LADDER INTERRUPTIONS/OBSTRUCTIONS

FIGURE 7 INADEQUATE WALKWAYS

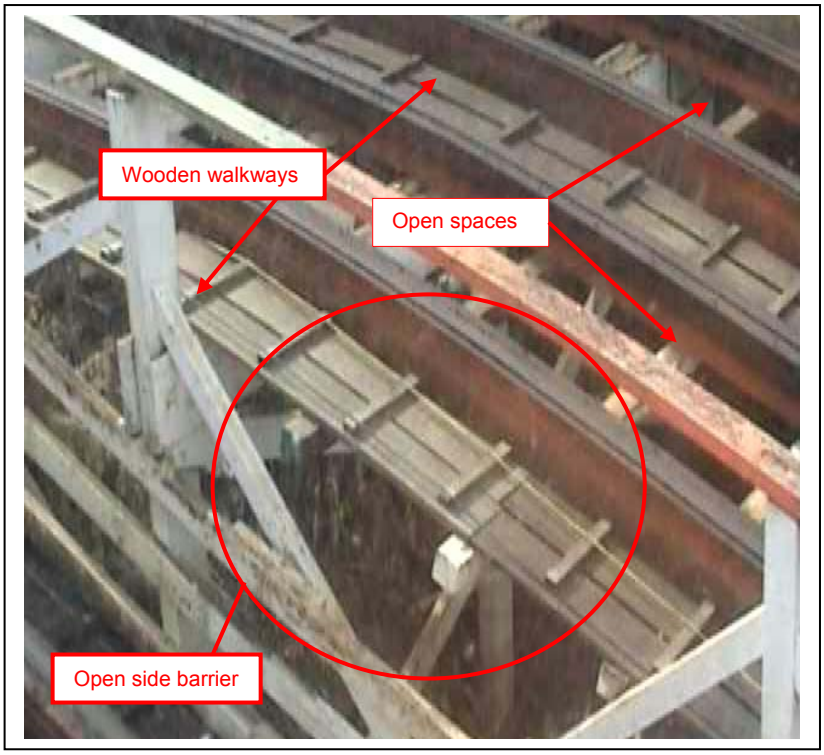

FIGURE 8 INADEQUATE WALKWAYS

FIGURE 9 INADEQUATE WALKWAYS

FIGURE 10 INADEQUATE WALKWAYS

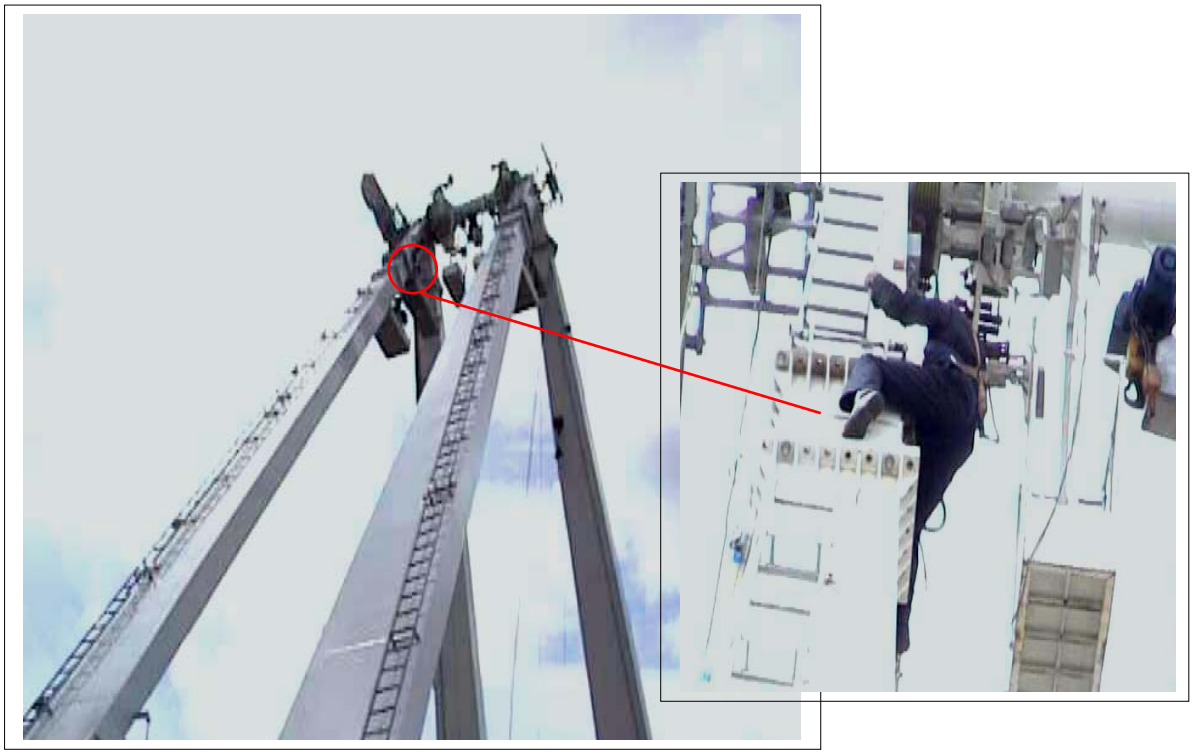

FIGURE 11 INADEQUATE TRANSFER

FIGURE 12 INADEQUATE TRANSFER

5.7 Working Platforms

In many cases it was not possible to undertake tasks at height on purpose-built work platforms, since most work within the fairgrounds is carried out directly on the tracks of rides and frames. In these instances the workers positioned themselves on the tracks, frame or structure, while carrying out the necessary work tasks. In such situations, it proved impossible to provide continuous edge protection and closure of openings below the worker to prevent falls occurring.

Use of scaffolding was not observed during the visits. This appeared to be due to a number of difficulties including but not limited to:

- Inadequate space
- Absence of suitable tie off points and structures
- Unsuitable ground conditions
- Short duration of work at a particular area
- Time to erect and dismantle, especially for travelling fairgrounds where time is at a premium
- Training requirements
- Transportation
- Cost
- Quantity of scaffolding required, where, for example, the amount of scaffolding work required to cover the complete build and dismantling of a medium size roller coaster would be excessive, especially in the case of travelling rides, where rides are regularly built and dismantled again in short period of times.

The use of MEWPs was at times difficult due to restrictions in access and space and unsuitable ground conditions. The use of MEWPs could also prove impractical, when the duration of the tasks at a specific location could often be extremely short. The staffing of a typical fairground can comprise self-employed workers, small teams or large organisations, therefore owning or hiring a MEWP may not be cost effective. Sharing the use of MEWPs between ride owners may not be a feasible option and could result in scheduling problems and failure to meet tight deadlines. This can be important where public access ways are restricted during the assembly and dismantling of travelling fairground rides.

Suspended cradles were used regularly and although generally providing an adequate working platform, occasionally workers were not equipped with PPE while reaching out of the cradles to carry out work tasks.

Integrated elevating working platforms were observed at several locations, where the working platform was formed from an existing moving part of the ride. Such platforms were present on drop tower type rides, where the elevating passenger shuttle cab doubled up as a working platform during the build and dismantling of the ride. While an integrated platform observed on one ride, Figure 13, had no edge protection or

adequate flooring, the platform observed on another similar ride, Figure 14, was fitted with fully enclosed guardrails and closed flooring to prevent workers and objects falling at height.

Working platforms were often not secured to the structure on which they were supported. At times the platform comprised merely of a plank of wood, loosely placed over two points, Figure 15.

Generally working platforms were inadequate and exhibited poor edge protection with gaps in flooring, which presented a risk of workers and objects falling over open edges and through openings. In some locations however, due to the clearance requirements for moving parts of rides, genuine difficulties existed in the installation of adequate enclosures and edge protection, where the tracks of rides were frequently positioned directly adjacent to the platforms. Figures 16-20 provide typical examples of inadequate platforms.

Structures supporting work places were at times unstable, especially those structures which were still only partly built.

Working platforms were occasionally overloaded by workers and work equipment and at times lacked the size required to provide a safe working area for the specific tasks involved.

Work surfaces were on occasion obstructed with trip hazards caused by work equipment and regularly lacked anti-slip protection. Under wet and icy weather conditions work surfaces were particularly slippery.

Portable ladders were frequently used as working platforms often providing insufficient reach, insufficient working area and inadequate stability for the works being undertaken, as demonstrated in Figure 24.

Partly built, unstable frames were frequently used by workers to provide a working platform while carrying out work at heights.

FIGURE 13 INTEGRATED WORKING PLATFORM WITH NO FALL PROTECTION

FIGURE 14 INTEGRATED WORKING PLATFORM WITH FALL PROTECTION

FIGURE 15 INADEQUATE UNSECURED WORKING PLATFORM

FIGURE 16 INADEQUATE WORKING PLATFORM

FIGURE 17 INADEQUATE WORKING PLATFORM

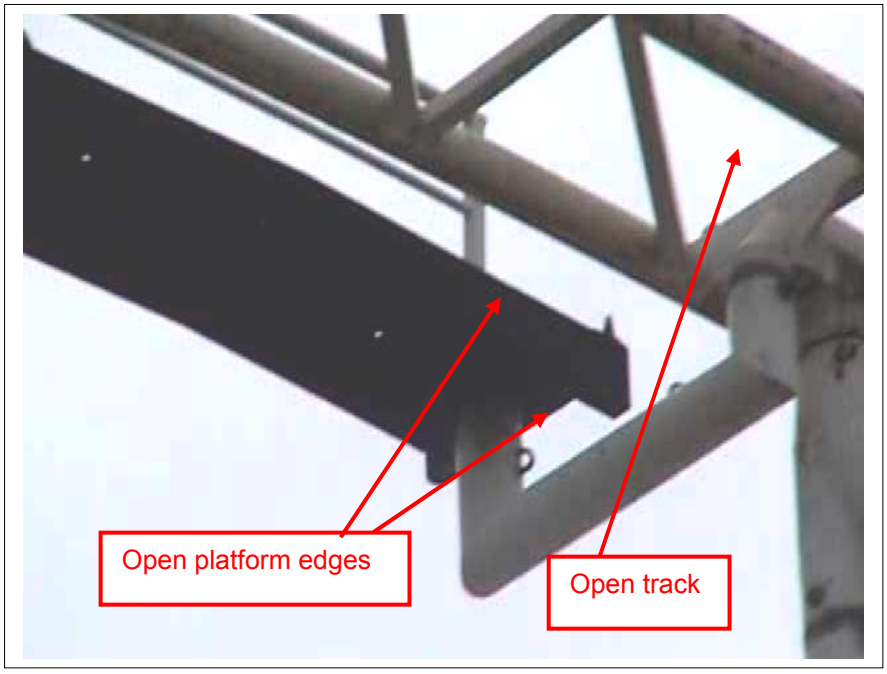

FIGURE 18 INADEQUATE WORKING PLATFORM

FIGURE 19 INADEQUATE WORKING PLATFORM

FIGURE 20 INADEQUATE WORKING PLATFORM

FIGURE 21 INADEQUATE WORKING PLATFORM

5.8 Collective Fall Protection

Collective fall protection measures, including safety nets and soft landing mats i.e. air bags and filled mats, were not observed in use during the visits. On many occasions the use of safety nets was restricted due to lack of suitable fixing points, especially during the assembly and dismantling of travelling fairground rides. The provision of soft landing systems may also be impractical at times due to the large area below the ride which would need to be covered.

5.9 Personal Protective Equipment (PPE)

5.9.1 Work restraint PPE

No work restraint equipment was evident throughout the survey to prevent workers reaching unprotected hazardous areas.

5.9.2 Work positioning PPE

Work positioning equipment was rarely used to aid the positioning of the worker while carrying out tasks. Occasions were observed when the worker would have benefited greatly by having both hands free to undertake hazardous tasks, for example while man-handling equipment into position, Figure 22. Where work positioning equipment

was observed, it was widely misused, often being incorrectly applied to fall arrest situations.

FIGURE 22 MAN-HANDLING OF EQUIPMENT INTO POSITION

5.9.3 Fall hazards

A number of fall hazards were encountered where the fall path was obstructed as shown in Figure 23. This would endanger the worker from serious impact during falls or cause damage to PPE.

Fall arrest equipment was also used in applications with insufficient free fall distance below the worker, where in the event of a fall the worker would hit the ground.

PPE was frequently used in situations where a potential existed for pendulum swing falls with serious consequence for workers impacting against solid or sharp structures, also shown in Figure 23.

Fall protection equipment was used regularly in situations where the equipment was in contact with sharp edges and abrasive surfaces, Figures 24, 25 and 26, which presented a risk of damage to and cutting of the PPE during normal use and under fall conditions. The open edges of working platforms frequently had sharp edges.

Fall arrest PPE was on occasions used in extremely oily and dirty environments, where fall arresters and line systems including rope, wire and rails were soiled with oil, which in the event of a fall may affect the safe operation of the equipment.

FIGURE 23 FALL HAZARD – OBSTRUCTIVE FALL PATH WITH PENDULUM SWING POTENTIAL

FIGURE 24 FALL HAZARD – PPE IN CONTACT WITH SHARP EDGES

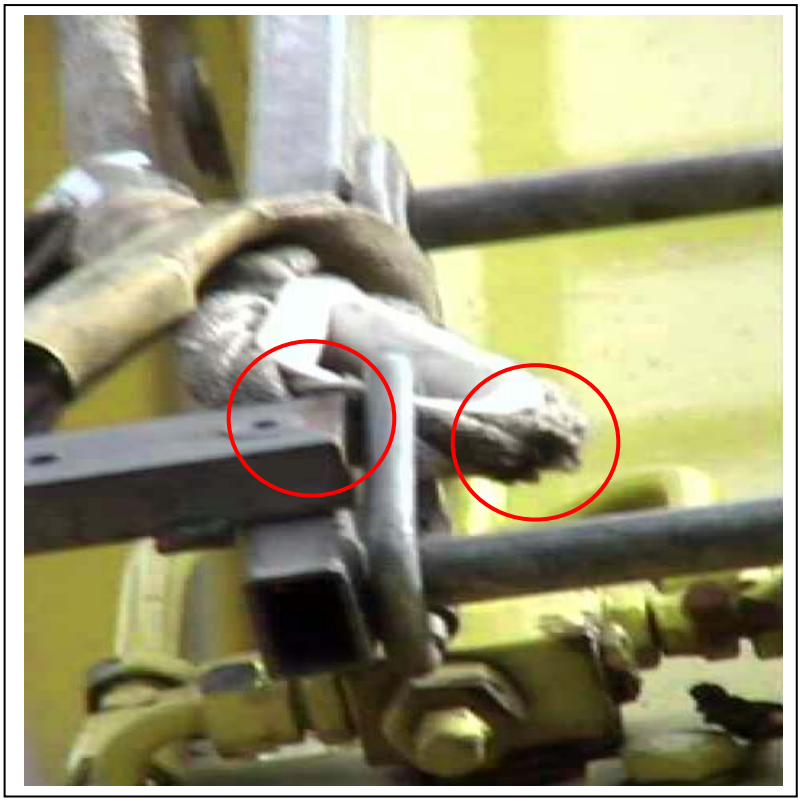

FIGURE 25 FALL HAZARD – PPE IN CONTACT WITH SHARP EDGES

FIGURE 26 POTENTIAL FALL HAZARD - SHARP EDGES

5.9.4 Selection and installation of PPE

On many occasions the wrong type of PPE was selected or incorrectly installed. This was either due to a lack of knowledge of the PPE and hazards and risks involved in the work activities, or at times due to the uniqueness of the ride and applications, where standard 'off the shelf' PPE from a catalogue did not suffice. Frequently there was a failure to seek advice directly from the manufacturer or supplier and on some occasions when advice was given it was incorrect. This could be as a result of technical information being diluted as it is passed down the supply chain, from manufacturers' technical staff to sales staff and to suppliers and distributors, who may not have been close to the technical development of the product or aware of the product's scope, limitations or compatibility. This also applies to PPE installers, where PPE installations at times proved inadequate, demonstrating a lack of understanding and technical knowledge of the PPE systems.

Examples of incorrect use of PPE are provided in the following sections.

- Workers were often equipped with single leg energy absorber lanyards which provided inadequate protection while manoeuvring between positions, when the use of twin leg energy absorber lanyards would have provided permanent protection by alternating between lanyard legs.

- The wrong type of connectors and lanyards were regularly used, and these at times proved incompatible with the structures to which they were attached. The selection of other devices may have been more appropriate. For example the use of snap hook or twist-lock type connectors may prove more suitable for applications where frequent connection and disconnection is required, as opposed to screw-gate connectors which are awkward and time consuming for the worker. For some applications retractable type lanyards conforming to EN360[8] or elasticated energy absorber lanyards conforming to EN355[9] might have been more suitable, where standard fall arrest lanyards introduced potential trip hazards.

- Fall arrest systems conforming to EN795 Class C[10], which are designed and EC type-tested for use on horizontal planes were installed on steep inclines, Figures 27 and 28. The purpose of a fall arrest system is to arrest the user on the line in a predictable, controlled fashion, within prescribed fall distances and arrest forces. When installed under inclined conditions this type of system is incapable of arresting the user on the line and incorrectly relies on collisions with intermediate fixings to stop the fall. This creates an unknown level of protection, which could vary from fall to fall, with unpredictable behaviour and potential damage to the system and fabric lanyard, during contact with other parts of the ride. The safety system may not protect the worker from serious injury or fatality in the event of a fall or downward stumble. It is essential that the system has been EC type-tested by the manufacturer and approved for use in the particular configuration, to ensure the integrity of the intermediate fixings, sliding trolley and couplings during the side impact loading which would arise during an inclined fall. The test required on this PPE system differs greatly from the standard type-testing normally conducted for horizontal use under European test standard BSEN795: 1997 Class C. Some of the systems observed were installed on rides over a decade ago, and as such it is possible that at that time no other systems were readily available on the market to accommodate this type of application. At the time of installation, the system may have reflected best

practice, but may not be as effective as other systems available on the market today.

- Fall arrest systems conforming to EN353-1[11], designed and EC type-tested for use on vertical planes were installed on inclines. Depending on the manufacturer's instructions and CE type-testing, these types of system may not be suitable for use on slopes. During 2004, HSE released a press warning[12] concerning the possible malfunction of vertical PPE EN353-I systems, where due to the outward motion of the lanyard, the traveller fails to lock on to the safety line and arrest the fall. This situation arose due to the current CE type test standard EN353-1:2002, which bases the test methods on the assumption that when a person falls, the fall is vertical. It has since been discovered that this is not always the case and that during a fall persons tend to fall backwards and outwards. This raises a concern when such systems are installed on inclines, where there may be a greater tendency for the worker to fall outwards, due to the sloped structure pushing the worker away. Such systems should only be used outside the vertical application on condition that they have been CE type tested in an inclined configuration and approved for use in Europe by a notified body.

- Fall arrest systems on vertical and inclined planes were frequently installed at unacceptable distances from the sides of ladders. This often resulted in workers violating the intended use of the PPE system by adding connections to increase the length of the lanyard or by substituting the intended lanyard provided by the manufacturer with other types, in order to allow freedom of movement to climb.

- Retractable type fall arresters conforming to EN360 were observed in use on solid sloped chute surfaces, Figure 29. Retractable lanyards operate by inertia sensing, where, at a given velocity they are designed to lock on and provide an immediate cushioned arrest. Standard 'off the shelf' retractable fall arresters, when used on a sloped chute, may not generate the same levels of inertia as a body in vertical free fall motion. This may result in failure of the device to stop the worker from sliding down the chute and into, in this case, the deep water below. Retractable fall arrester manufacturers, on special request, may be able to adjust the braking mechanism of the device to allow operation at specified angles.

- The installation of some types of fall arrest systems may not comply fully with the manufacturer's installation instructions and EC type-testing, when additional parts and fixings have been substituted. Such unapproved modifications to PPE installations may prove to be inadequate and result in system failures from undesirable loading directions, higher arrest forces and greater fall distances. Figure 30 shows a typical example where the lack of suitable rigid posts may have resulted in the addition of a cantilever arm to support a corner piece cable guide.

- Flexible fall arrest systems conforming to EN353-2[13] were used outside the intended scope and design of the equipment, where the line was fixed between two points in a sloped configuration. This may result in the fall arrester cutting through the rope due to the loading direction in a fall. EN353-2 flexible fall arrest systems are intended and CE type-tested for vertical applications, where the rope will hang freely in a vertical orientation.

FIGURE 27 HORIZONTAL SYSTEMS ON STEEP INCLINES

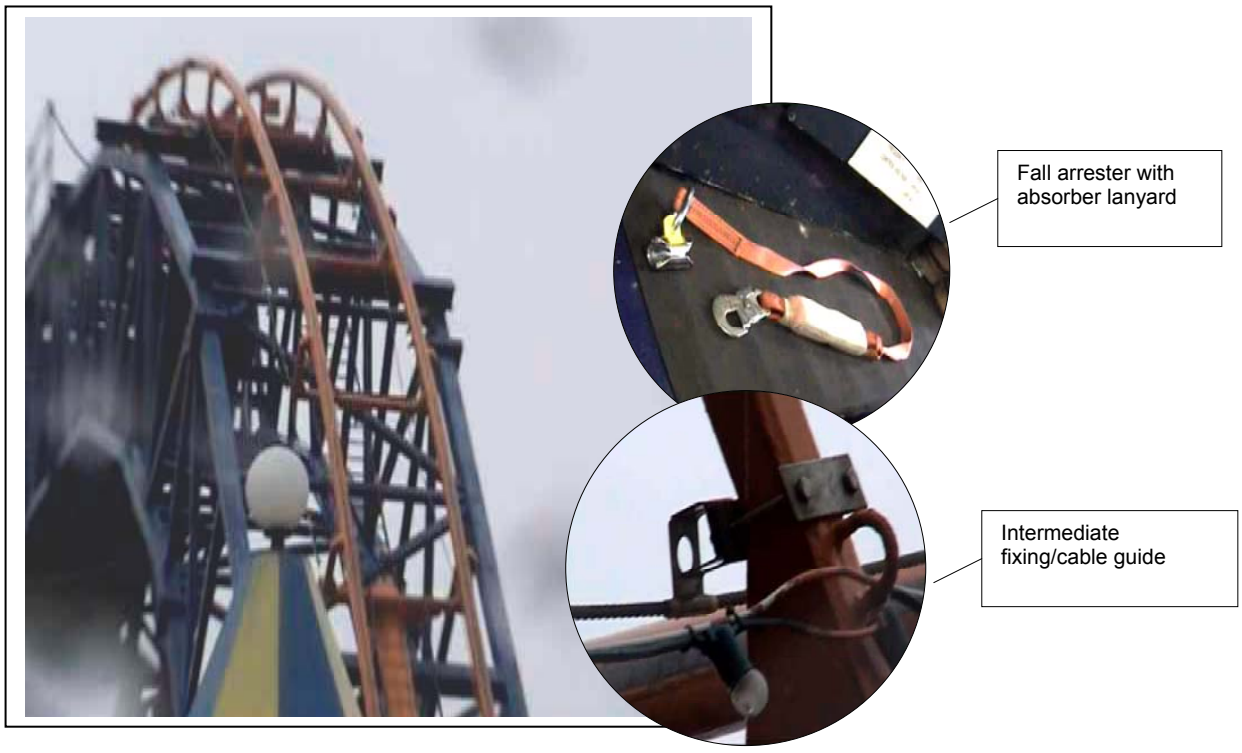

FIGURE 28 HORIZONTAL SYSTEMS ON STEEP INCLINES

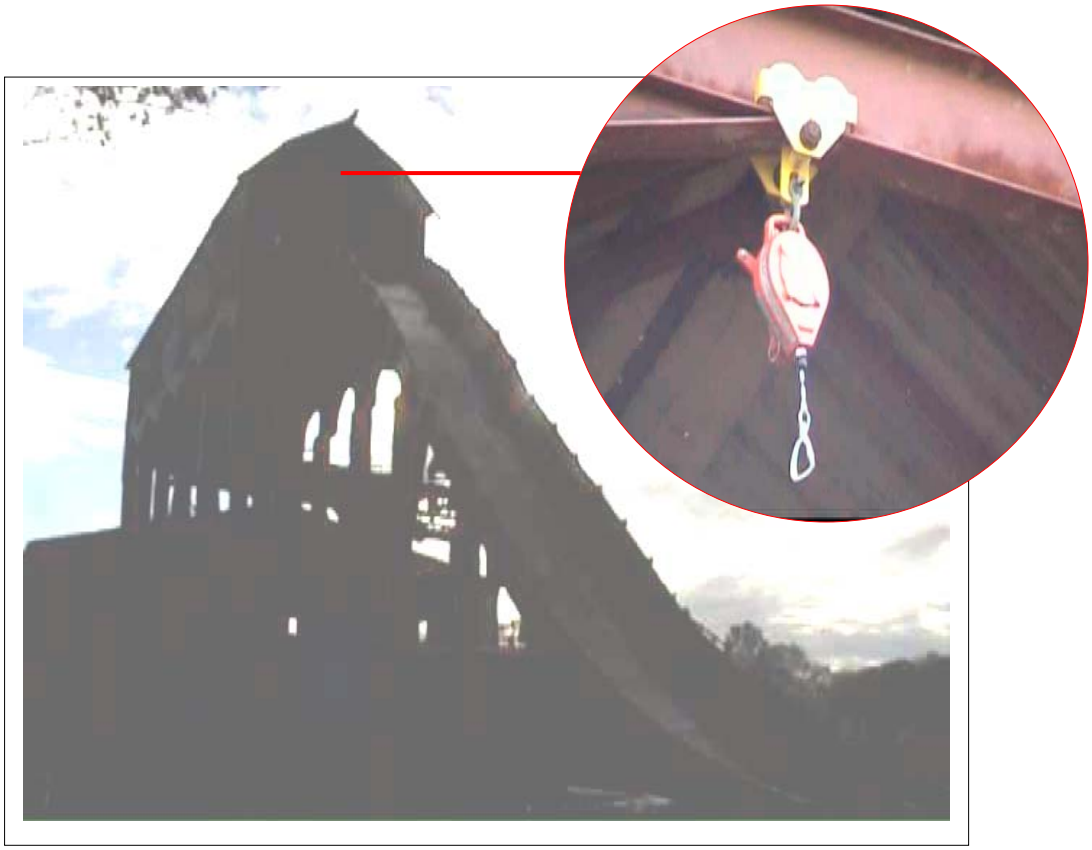

FIGURE 29 RETRACTABLE FALL ARRESTERS USED ON SLOPED CHUTES

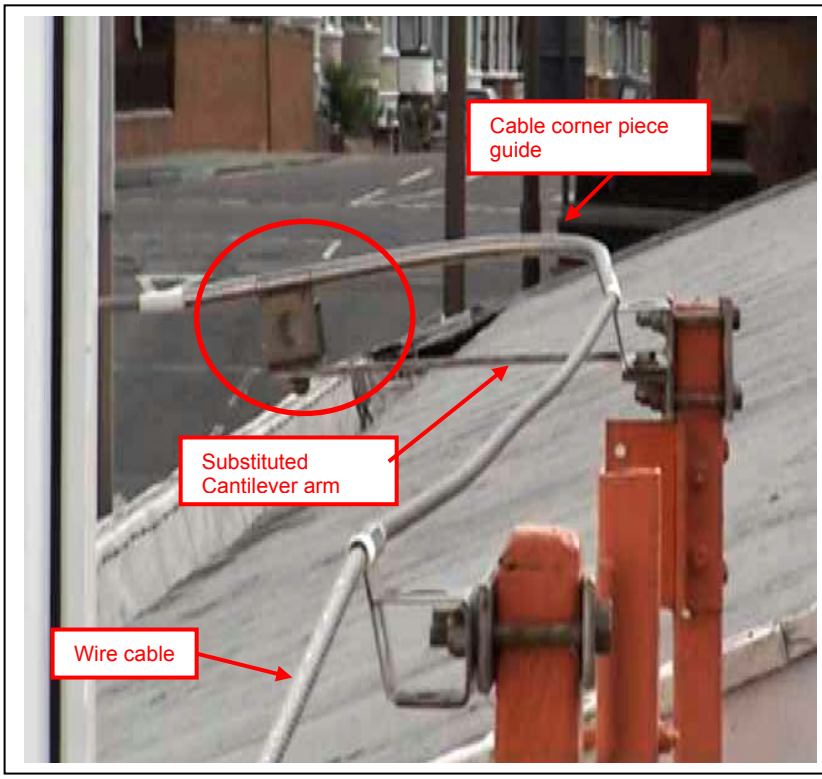

FIGURE 30 POSSIBLE INCORRECT INSTALLATION

5.9.5 Selection and control of structural anchor points

Structural anchor points to accommodate PPE systems were often unsuitable for the intended purpose.

- Structural anchor points were generally chosen at random with no identification or validation of their integrity and fitness for purpose.

- Workers frequently failed to inspect structural anchor points prior to use.

- Structural anchor points lacked periodic examination carried out by competent persons.

- The selection of anchor points frequently resulted in fall arrest PPE anchored to points below the attachment point of the worker's harness, and at times below foot level. Manufacturers will normally instruct that anchor points are as far above the attachment point of the harness as possible, to lessen the severity of the fall, by reducing free fall distances and subsequent arrest forces. Although on a large number of occasions, selection of anchor points below the harness points was inevitable due to an absence of suitable overhead structural anchors, there were occasions when workers could have attached to structures above the attachment point of the harness.

- It was sometimes observed that PPE lanyards were attached to moving fixtures, including swivelling guardrails, Figure 31, which in a fall situation introduces unknown movement and unpredictable performance of the PPE. Most guardrails, unless specified otherwise by the manufacturer/installer are generally unsuitable for fall arrest applications, where the majority are designed and intended to sustain much smaller loads typical of access prevention and restraint.

- PPE was at times fixed to hollow type aluminium ladders, which depending on the work requirements and number of workers supported, may not be strong enough to sustain the potential dynamic forces which could arise during a fall.

FIGURE 31 ANCHORING OF PPE ON GUARDRAILS

5.9.6 Inspection and control of PPE

A significant lack of care and maintenance of PPE was frequently observed. Maintenance is imperative in retaining the integrity of the equipment to provide effective fall protection.

- Workers regularly failed to carry out inspections of the PPE before use to determine the suitability and integrity of the equipment. This also included a lack of inspection of the workplace and prevailing conditions, including fall hazards and weather, to identify the presence of any hazards and risks which may have made working at height unsafe.

- Often PPE was not subjected to periodic thorough examination by a competent person to enable an evaluation of equipment safety.

- Some PPE appeared extremely old and may not have complied with current UK legislation requirements.

- On occasions, PPE in use appeared to have already been involved in a fall, Figure 32, where energy absorber packs were parted and extended, showing a failure to immediately withdraw the PPE from service following a fall, as instructed by PPE manufacturers.

- Generally PPE was in a poor condition, Figures 33 – 35, with at times extreme damage evident which may have significantly affected the operation and reliability of the equipment in a fall situation. Typical conditions included:

- Deformation of PPE system components, including cable guides and anchorages
- Dirt, water and oil soiled fall arrest lines, where the oil would greatly affect the ability of the fall arrester to stop on the line
- Abrasion, wear and laceration of PPE textiles, where PPE was regularly used in contact with sharp and rough surfaces

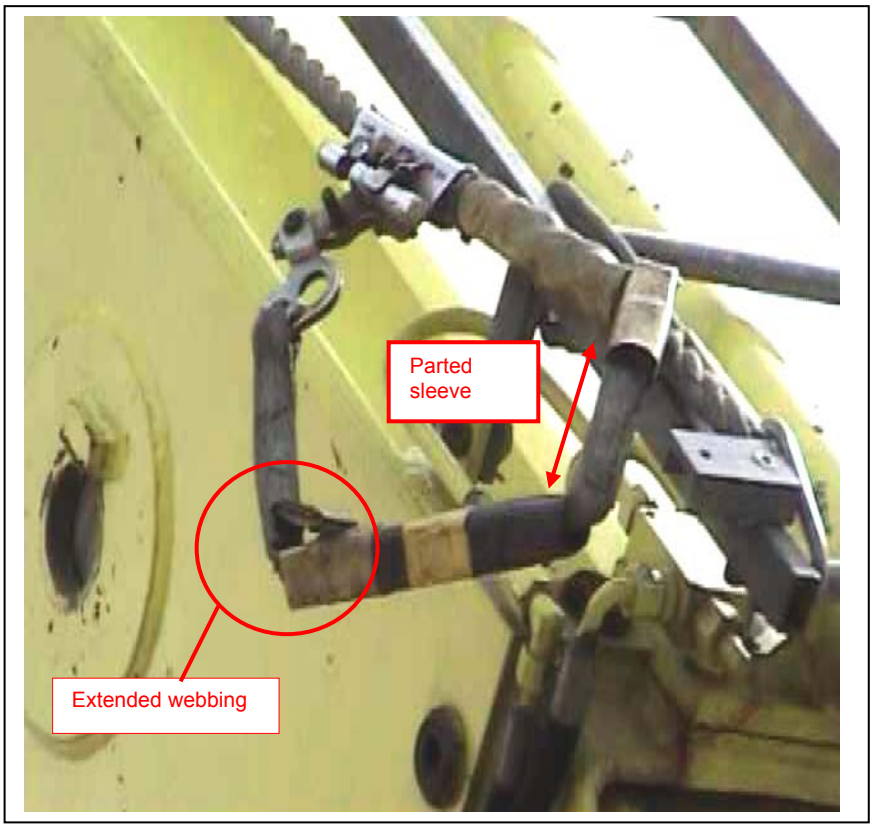

FIGURE 32 DAMAGED/USED ENERGY ABSORBER LANYARD

FIGURE 33 DEFORMED UNUSED FALL ARREST CABLE GUIDE

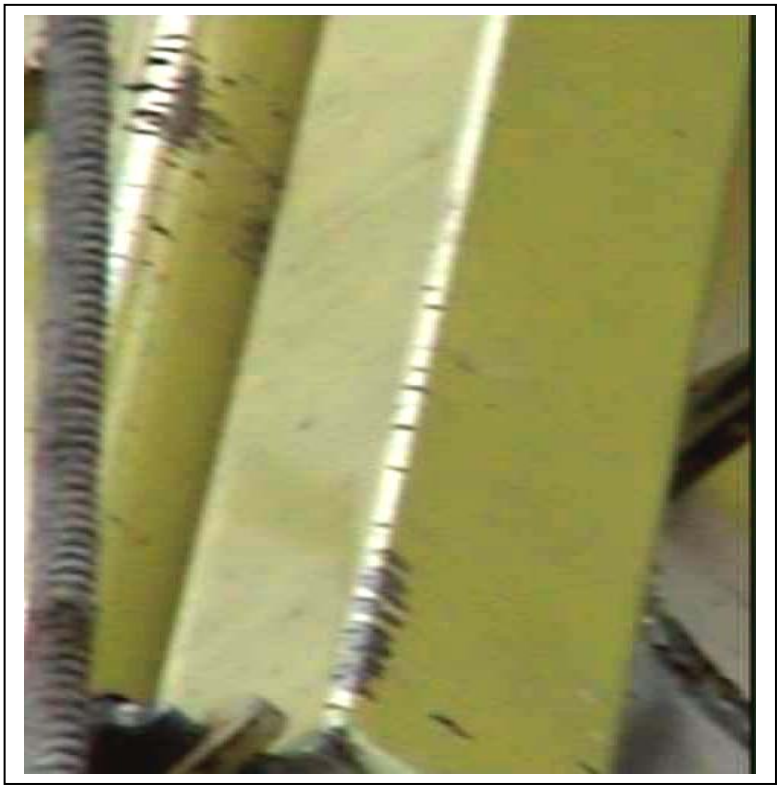

FIGURE 34 OIL SOILED FALL ARREST LINE

FIGURE 35 AGED, SOILED AND WORN PPE

5.9.7 PPE training and awareness

Workers generally demonstrated a lack of PPE training and awareness, resulting in misuse and abuse of equipment. This included, but was not limited to:

- The use of work positioning equipment for fall arrest applications, particularly work positioning lanyards, Figure 36, and waist belts. It is important that workers are aware of the limitations and differences between PPE for work positioning and PPE used for fall arrest. The work positioning lanyard and belt is not designed nor CE type-tested for fall arrest. The equipment is intended for positioning purposes only, in situations where no potential for free fall exists. Unlike fall arrest lanyards, which arrest falls within the EU maximum allowable 6 kN force limits, work positioning lanyards have no energy absorber element to dissipate the impact energy and may, as a result, rupture and release the worker, or transfer life-threatening loads to the worker. During a fall the waist belt is unable to provide the worker with adequate body support and proper distribution of the impact forces to ensure a safe mode of arrest. This may result in serious injury such as paralysis and failure of internal organs or fatality from failure of the waist belt.

- Workers at times failed to make proper use of harness attachment points to enhance ease of work, when connecting to the front thoral point as opposed

to the rear point would frequently have prevented the lanyard hindering the worker and restricting freedom of movement.

- At times anchoring techniques were inadequate, Figures 37-38, where lanyard connectors and webbing fouled other parts of the structure. This may result in possible fracture of the hook by incorrect axis loading during impact or failure of the webbing from the abrasive rubbing and cutting on sharp edges.
- On many occasions the absence of overhead structures prevented workers attaching fall arrest lanyards above the attachment point of the harness, as instructed by PPE manufacturers to minimise free fall distances and subsequent arrest forces during a fall. However, workers still failed to anchor lanyards above the attachment point of the harness when suitable overhead structures were available, Figure 39.
- Poor adjustment and fitting of harnesses was observed on many occasions, Figure 40. In order to ensure the correct fall motion and safe arrest, harnesses must be correctly adjusted to ensure the attachment points are located at the correct positions, as instructed by the manufacturer.
- Two separate single leg energy absorbers lanyards were at times used in parallel as a substitute for twin leg energy absorber lanyards. Twin leg energy absorber lanyards are not comparable with two separate single leg energy absorber lanyards used in parallel. The twin leg model comprises one energy absorber element linked to two separate lanyards, to provide alternating attachment and arrest forces within 6 kN. Using two separate single energy absorber lanyards introduces two energy absorber elements, which when operated in parallel will generate double the arrest forces, which may greatly endanger the worker's safety.
- Workers frequently wrapped the free leg of twin leg energy absorber lanyards around their bodies, when the second leg was not in use, Figure 41. Such connection around the body may hinder the operation of the energy absorber, preventing extension of the energy absorber during a fall, where the energy absorber will only tear out up to the point at which the free leg tied around the body becomes taut.
- Occasionally, energy absorber lanyards were observed connected in series with retractable type fall arresters, Figure 42. Additional energy absorber elements should not be added to retractable type fall arresters, where cushioning the arrest forces applied to the retractable arrester may prevent the device from locking on, or may create a ratcheting effect, with the device alternately locking on and off.
- Workers regularly increased the length of fall arrest lanyards by adding additional connections, which could have resulted in serious injury or fatality in the event of a fall. This included energy absorber lanyards conforming to EN355 and specialised energy absorber lanyards supplied as part of a fall arrest system conforming to EN353 i.e. vertical wire systems. Increasing the length of an absorber lanyard in turn increases the potential free fall distances and subsequent arrest forces, resulting in unpredictable system performance, where EC type-testing is carried out specifically on the lanyard supplied by the manufacturer and detailed in the CE approval certificate.

- Workers widely misused rigid type fall arrest systems conforming to EN353-1 where the manufacturer's absorber lanyard was substituted with both 2-metre energy absorber lanyards and 2-metre work positioning lanyards. EN353-1 systems are designed to operate within minimal fall distances and arrest forces and therefore normally employ extremely short lanyards/connections, normally less than 300mm, to ensure arrest distances within 1 metre and arrest forces within 6 kN. It is essential that workers use the lanyard intended for the fall arrest system, as specified by the manufacturer, and do not add any connections to increase the length. Workers must under no circumstances attach 2-metre long energy absorbers lanyards to the system, which could produce over 4 metres of free fall and greatly exceed the system design limitations.

- Workers at times utilised EN353-1 systems for work positioning purposes. The majority of EN353-1 systems are for fall arrest purposes only and are not intended, nor CE type tested, for use in work positioning and restraint. Unless the manufacturer claims such features, workers should not suspend themselves from these systems to prevent inadvertent release of the fall arrester on the safety line.

- PPE user instructions, which are supplied by the PPE manufacturer for new PPE were frequently not accessible or available to workers. Without reference to the user/installation instructions it is difficult to ascertain the intended purpose of the PPE and its associated limitations, warnings, inspection regime, maintenance requirements, storage procedures and the expected lifetime of the equipment.

- Workers lacked training and awareness of the PPE in use, where, on the majority of occasions, no internal or external training was carried out to cover the use of the equipment, work techniques or provisions for rescue provisions.

FIGURE 36 WORK POSITIONING LANYARD USED FOR FALL ARREST

FIGURE 37 POOR ANCHORING TECHNIQUES

FIGURE 38 POOR ANCHORING TECHNIQUES

FIGURE 39 PPE ANCHORED BELOW THE ATTACHMENT POINT OF THE HARNESS

FIGURE 40 POOR ADJUSTMENT OF HARNESS WITH ATTACHMENT POINT POSITIONED AT THE WAIST

FIGURE 41 FREE LEG OF TWIN ENERGY ABSORBER LANYARD TIED AROUND WORKERS WAIST

FIGURE 42 ENERGY ABSORBER LANYARD CONNECTED IN SERIES WITH A RETRACTABLE TYPE FALL ARRESTER

5.9.8 Rescue Provisions

No rescue plans or recovery equipment were in place for any working at height activities reviewed as part of the survey. Such equipment is essential to facilitate the speedy and safe recovery of falls victims in order to prevent further discomfort, injury or even death.

There was a lack of awareness of rescue needs, hazards and risks, particularly to suspension trauma, a condition which affects persons suspended in a harness for a given period of time. There was no awareness of the causes, effects and consequences of suspension trauma, which, with proper planning, can be minimised.

Suspension trauma results from accumulation of blood in the veins at the lower part of the body due to gravity and lack of movement caused by being in a suspended position. Due to the immobility of the legs, blood is not effectively circulated around the body, which can affect the functioning of the brain and other vital organs, such as the kidneys and heart. The victim can experience a number of symptoms including sweating, breathlessness, nausea, dizziness, paleness, hot flashes, low blood pressure, slow heart rate, fast heart rate, loss of vision, faintness, unconsciousness and possibly death. Such effects can occur in relatively short periods of time, as little as 15 minutes, dependent on a number of contributing factors such as immobility of the legs, pain, injuries, fatigue, shock, dehydration, hypothermia, cardiovascular disease, respiratory disease and loss of blood. In order to mitigate the consequences of suspension trauma a number of steps can be taken including minimising the duration of suspension, ensuring that a comfortable fitting harness is used to reduce strangulation around the leg arteries and the use of rescue aids such as rescue straps and leg loops to raise the legs to an upright position to improve blood circulation. Proper training in rescue and first aid is essential to promote awareness of this condition.

6 CONCLUSIONS

The conclusions from the review raise serious concerns for the safety of workers within the fairground industry when carrying out work at height, where often extreme risks are taken, with little obvious consideration of the potential for serious injury or death. During the survey management and employees frequently appeared negligent in ensuring that safe systems of work were established and adhered to. It is acknowledged that special conditions exist within the fairground industry, but these conditions only heighten the need to ensure that hazards and risks are properly identified and controlled. The sector appears to be in significant need of improvements to enhance the current levels of protection afforded to workers when working at heights.

The conclusions from the review are grouped under generic headings in sections 6.2 to 6.9. These conclusions must be understood in the context of the special conditions which are prevalent in the industry, as set out in Section 6.1.

6.1 Special Conditions

It was observed that the fairground industry regularly experiences a number of specific problems and related hazards which increase the difficulties and risks encountered when working at height. These include:

- Working in outdoor environments under inclement weather conditions, which can greatly affect the safety of workers and work equipment
- Working under extreme pressure to undertake erection and dismantling of rides to very tight deadlines
- Poor ground conditions (soft and uneven)
- Restrictions in access and limitations in space to accommodate suitable work equipment
- The absence of suitable structures to provide anchorages for fall protection systems (including collective protection and PPE)
- High transportation costs for certain types of work equipment such as MEWPs and scaffolding for use in travelling fairgrounds
- The uniqueness of fairground rides and related work activities makes it extremely difficult to provide generic workable solutions to allow safe working at height for all ride types; where each ride must be treated and assessed individually

6.2 Avoidance of Falls

The preferred option of the WAHR is the avoidance of falls. However, the majority of work at height activities in the fairground industry is necessary and cannot be avoided.

6.3 Prevention of Falls

The second preference outlined in the new WAHR hierarchal approach is the prevention of falls. It was frequently observed that difficulties exist in the prevention of falls, where practical complications limit the selection of suitable work equipment.

6.4 Mitigation of Falls

6.4.1 Many instances of working at height activity observed throughout the survey showed that no measures were in place to protect workers falling distances, where a potential consequence of serious injury or death existed.

6.4.2 Where fall protection measures were in use, it was observed that the fairground industry relied heavily on PPE to minimise the consequences of falls from height, which is the last line of defence outlined in the new WAHR hierarchal approach. Little or no use was made of collective protection, work restraint PPE or work positioning PPE.

6.5 Assessment and Control of Risks

Major failings were evident in the management of the risks associated with falls from height, where a lack of effective assessment to identify and control the hazards and risks was observed.

6.6 Selection and Use of Work Equipment

6.6.1 Failings were observed in the selection of suitable work equipment (including PPE) and in the adoption of control measures to provide staff with effective fall protection when working at heights.

6.6.2 Difficulties are regularly experienced in the sourcing of suitable PPE systems from the market to accommodate unique rides and work applications. This is often a consequence of not seeking proper advice and guidance from competent persons and suppliers.

6.6.3 PPE was often used outside the manufacturer's approved and intended scope, and, as a result, workers were often left without effective protection in the event of a fall occurring.

6.7 Care of PPE

Observations made during the survey indicate that major failings exist in the control and care of work equipment. This is particularly the case with PPE, where equipment was often in poor condition, which was indicative of poor inspection and maintenance regimes. This included failure to carry out pre-use inspections of the equipment and periodic inspections/examinations to ensure the continued safe functionality of the equipment.

6.8 Staff Training

The majority of staff working at height lacked adequate training and awareness to ensure proper and safe use of the equipment. PPE was generally misused and abused by workers, and because of this it afforded little protection.

6.9 Recovery of Victims

No provisions at all, neither work equipment or procedures, were in place to allow for the safe and speedy recovery of falls victims. A general lack of understanding of rescue needs was evident.

7 RECOMMENDATIONS

7.1 Risk Assessment

A risk assessment should be carried out for all work at height activities in accordance with the new WAHR, ensuring that the safe working at height hierarchical approach of Avoidance, Prevention and Mitigation is adopted.

The risk assessment should identify all working at height activities and assess all associated hazards and risks, including methods for access to and egress from the workplace, suitability of personnel and prevailing site conditions.

Steps must be taken to control the risks identified in the assessment as suggested in the following sections.

- **Avoidance**

  Every effort should first be made to avoid working at heights by exploring other means to perform the tasks. These could include, where reasonably practicable, assembly of rides at ground level and, thereafter, craning the ride into position or the use of work equipment and aids such as extension poles, jet sprays and gin wheels for selected activities.

- **Prevention of falls**

  Where avoiding working at height is not reasonably practicable, suitable and sufficient measures should be taken to prevent workers and equipment from falling distances liable to cause personal injury. This may be achieved by employing suitable installations and work equipment, such as walkways, working platforms, edge protection, enclosures and MEWPs, to provide safe places of work.

- **Mitigation**

  In the event that the risk of falling still exists, steps should be taken to minimise the distance and consequences of a fall.

  This should first be approached by exploring collective fall protection, e.g. safety nets, air mats, filled landing bags, before opting for PPE, which should always be a last resort and justified, within the risk assessment, on the grounds that no other safer means are reasonably practical.

  Where PPE is deemed necessary, consideration should first be given to work restraint PPE, to prevent workers reaching hazardous areas such as open edges.

  Where it is not reasonably practicable to use work restraint PPE to prevent workers from accessing hazardous areas, consideration should be given to work positioning PPE (used in conjunction with a fall arrest PPE back-up

system) to provide adequate support for, or suspension of the worker, so ensuring that the worker adopts the correct posture and has both hands free for conducting the required tasks.

Where no other safer means are reasonably practicable, fall arrest PPE should be selected to provide a safe arrest of the worker in the event of a fall.

7.2 Access, Egress and Places of Work

In order to prevent falls from occurring, adequate walkways, stairways and platforms should be provided, where reasonably practical, to give safe access and create a safe place of work. Platforms and access routes should be:

- strong, secure and stable enough to support the required loads.
- supported by structures which are strong, secure and stable enough to support the required loads.
- located on even and firm surfaces.
- of adequate size and dimensions to accommodate the worker and work equipment.
- free of trip hazards and obstructions from equipment, cables and other objects.
- fitted with adequate edge and floor protection i.e. guardrails, to prevent workers and objects falling from edges and through open floors.
- provided with effective anti-slip surfaces.
- secure from the intrusion from moving parts.

Where no existing safe place of work or adequate means for access and egress are possible, consideration should be given to the use, where reasonably practicable, of MEWPs, suspended working platforms and other types of elevated platform with adequate edge and floor protection, to provide safe access and a secure workplace.

Consideration should be given, where reasonably practicable, to the use of scaffolding, including lightweight mobile towers with adequate edge protection, to provide staged access to and egress from the workplace and to provide, where applicable, a safe working platform for carrying out the work tasks.

Guardrails where used to provide edge protection should be secure, stable and strong enough for the purpose for which they are intended. They must be strong enough to support dynamic forces where used as an anchorage point for attachment of fall protection systems such as nets and PPE. Guardrails should be adequately enclosed to prevent workers and objects from falling through openings.

Ladders should only be used to provide access and a place of work where a risk assessment shows that no other reasonably practicable means is suitable for the particular task. Ladders should satisfy the following criteria:

- If fixed ladders are used, where serious injury or death could occur in the event of a fall, consideration should be given to fall arrest systems, including:

  - rigid systems conforming to EN353-1
  - flexible systems conforming to EN353-2
  - long range retractable type fall arresters conforming to EN360

  These types of PPE enable users to climb with both hands and in the event of a fall provide a controlled arrest within short distances and prescribed arrest forces.

- Ladders spanning more than 9 metres should, where reasonably practicable, be fitted with landing/resting platforms at suitable intervals.

- Fixed ladders used for access must be long enough to protrude above the place of landing and provide a safe means of transfer to the place of work.

- Ladders must be stable, secure and strong enough to support the required loads. This may at times include dynamic forces experienced during falls from those ladders which are fitted with fall arrest systems.

- Swivelling, interlocking and extending ladders must be prevented from moving while in use.

- Where ladders are interrupted and obstructed, secure foot-holds and hand-holds must be made available to ensure safe transfer.

Climbing and working directly on frames and structures should be avoided where possible, with consideration being given to alternative methods to provide safe access and a safe work platform to conduct the necessary tasks. Where used, frames and structures should:

- Be strong, secure and stable enough to support the required loads, especially frames which are part built. This may include dynamic forces experienced during falls from those frames which are fitted with fall protection equipment.

- Be free from obstructions and hazards, including sharp edges, trip and slip hazards, which may endanger the worker or damage equipment during normal use or in fall conditions.

- Have adequate hand-holds and foot-holds.

- Where applicable, have suitable fall protection to ensure safe transfer between positions. Where the use of safety nets and soft landing systems are impractical protection may, as a minimum, be provided by twin leg energy absorber lanyards, conforming to EN355. Alternate use of lanyard legs provides the worker with a permanent method of attachment.

Where walkways, stairways, working platforms, MEWPs, suspended cradles and integrated elevating working platforms present a fall hazard, and where the use of collective protection such as safety nets and soft landing systems is not reasonably practicable, consideration must be given to PPE. This may be a single system or a combination of systems to provide a safe place of work and transfer between locations including:

- rigid fall arrest systems conforming to EN353-1
- flexible fall arrest systems conforming to EN353-2
- retractable fall arresters conforming to EN360
- temporary and permanent anchorage systems conforming to EN795 including flexible and rigid horizontal fall arrest systems

Carrying objects and tools while climbing should be minimised with consideration given to alternative means including gin wheels, hoists and tool belts.

7.3 Danger Areas

Where there is a risk of objects or personnel falling from a height, provisions should be taken to ensure that hazardous areas are sealed off to prevent entry of other persons who may be endangered.

7.4 Selection of Work Equipment

All work equipment selected for working at heights, including MEWPs, scaffolding, guardrails, ladders, collective protection and PPE, must satisfy the UK legislation in force, to ensure the safe installation, operation, inspection, training and maintenance requirements.

Requirements for work equipment are specified within the new WAHR under the appropriate schedules.

7.5 Assessment of Personnel

An assessment should be made of staff working at height, including levels of fitness, competence, medical and health conditions, which may endanger them or other persons while working at height.

When using fall protection equipment, the weight of any tools and equipment in addition to the body mass of the worker should be considered when selecting the appropriate work equipment. Special provisions may need to be made to provide adequate safety. This could, for example, involve sourcing special harnesses and lanyards from PPE manufacturers to suit total user weights exceeding 100 kg.

7.6 Training and Competence of Personnel

To work safely at height, it is essential that staff are adequately trained and deemed competent both in the use of all work equipment and in the performance of specified tasks. This may require continued supervision by management to assess staff competence levels.

It is essential that staff are trained by competent persons. These may be persons that are specially authorised by the work equipment manufacturer.

7.7 Inspection of Workplace and Conditions

Inspections should be made of the workplace environment and prevailing conditions to determine whether working at height is safe. This includes an assessment of general hazards such as weather conditions, ground conditions, strength and stability of the workplace, fall obstructions, slip and trip hazards and contaminants such as water, chemicals or oil.

7.8 Inspection of Work Equipment before Use

All work equipment, including but not limited to, ladders, scaffolding, MEWPs, suspended cradles, integrated working platforms, guardrails, collective fall protection systems and PPE should be inspected by a competent person before use.

In general, this should be done in accordance with the manufacturer's instructions.

7.9 Management System

A management system should be established to organise, plan and control all work at heights. The management system should assess risks, establish work procedures and retain records and documentation.

7.9.1 Work procedures

Work procedures should be established to ensure effective management and control of safe working at heights. Typical procedures include:

- Procedures for identifying hazards and assessing risks
- Procedures for selection, procurement and installation of work equipment
- Procedures for identification and control of work equipment.
- Procedures for selection of competent training providers
- Procedures for inspection, periodic examination, maintenance and care of work equipment (including PPE)
- Procedures for training, competence and supervision of staff

Work procedures should also be established for operational staff to ensure safe methods of work are adhered to. These procedures should cover, but not be limited to, the following:

- Procedures for inspection of workplace and conditions
- Procedures for inspection of work equipment (including PPE)
- Procedures for use and care of work equipment (including PPE)
- Procedures for performing specific working at height duties

- Procedures for emergency rescue/evacuation (including lone working)

7.9.2 Record Keeping

Records and documentation should be maintained and retained covering, but not limited to, the following:

- Risk assessments
- Work procedures
- Work equipment purchase documents
- Work equipment manufacturer's user and installation instructions
- Work equipment inspection and periodic thorough examination records
- Workplace inspection records
- Work equipment maintenance records
- Staff training and competence records

7.10 Personal Protective Equipment (PPE)

7.10.1 Selection and procurement of PPE

All PPE used for fall protection must be CE marked to the applicable EN standard(s) or, where none exists, to a specification authorised by the notified body.

All new PPE must be accompanied by a 'declaration of conformity' certificate identifying the product, manufacturer, standards/specifications of conformity, CE approval certificate number and details of the notified body who issued the CE approval certificate.

It is important that the buyer ensures that the CE mark(s) and any other product claims made in writing by the manufacturer satisfy the intended use of the PPE. It is essential for safety reasons that the product is not used outside the manufacturer's instructions.

All PPE (including second-hand PPE) should be accompanied by user/installation instructions in the official language of the country of destination. The user instructions should be used to aid the preparation of work procedures.

The buyer must ensure the PPE is procured from a competent supplier i.e. manufacturer, supplier or distributor. Often due to the uniqueness of fairground rides and work applications, selecting the correct type of PPE may require input and advice from the PPE supplier. Therefore it is important that the supplier, in addition to having a clear understanding of the buyer's requirements, has sufficient technical knowledge of the product to provide guidance and ongoing support including CE

approval scope, product limitations, compatibility with other products, training requirements, inspections and maintenance.

Appendix 3 of this report contains the background and legal requirements for fall protection PPE, and a guide to the selection and procurement of PPE.

7.10.2 Work restraint PPE

A work restraint PPE system should comprise:

- A suitable body support element – either a waist belt (EN358[14]), full body harness (EN361[15]) or sit harness (EN813[16]). Some full body harnesses combine all functions in one multi-purpose unit.

- A suitable lanyard – either fixed or adjustable conforming to either EN358, EN354[17] or EN355.

- A suitable connector conforming to EN362[18] which is compatible with the structural anchor point.

- A suitable structural anchor point – should the structural anchor point be deemed unsuitable for direct fixing of the connector, it may be necessary to install a PPE anchor device conforming to EN795 as an interface between the structure and connector. Typical anchor devices include eyebolts, anchor slings and clamps.

Anchor points used for work restraint applications must be strong enough to withstand the required load and an acceptable margin of safety.

Under no circumstances should restraint equipment be used in a fall arrest situation where there is a danger of free fall occurring.

Workers should be trained in the use of restraint equipment and techniques.

7.10.3 Work positioning PPE

A work positioning PPE system should comprise:

- A suitable body support element – either a waist belt (EN358), full body harness (EN361) or sit harness (EN813). In situations requiring suspension of the user a suitable sit harness to EN813 should be used to permit adequate positioning and posture.

- A suitable lanyard – either fixed or adjustable conforming to EN358, EN354 or EN355 should be used.

- A suitable connector conforming to EN362 which is compatible with the structural anchor point.

- A suitable structural anchor point – should the structural anchor point be deemed unsuitable for direct fixing of the connector, it may be necessary to install a PPE anchor device conforming to EN795 as an interface between the structure and connector.

It should be noted that for certain types of rope access and positioning techniques other types of equipment may be necessary in addition to that to that specified above, including specific types of mountaineering rope, ascenders, descenders, and support aids e.g. bosun's seat.

Work positioning systems must be used in conjunction with a suitable fall arrest back-up system.

Anchor points used for work positioning applications must be strong enough to withstand the required loads and an acceptable margin of safety.
Under no circumstances should work positioning equipment be used for fall arrest in a situation where there is a danger of free fall occurring.

It is essential that workers are adequately trained and competent to enable safe use of the intended work positioning and fall arrest equipment.

7.10.4 Fall arrest PPE

A fall arrest PPE system must comprise:

- A suitable body support element – only a full body harness conforming to EN361 is acceptable for use in fall arrest applications. It is essential that workers are aware of the correct harness attachment points to be used with the specific PPE system, especially in instances where full body harnesses incorporate other attachment points for other purposes, such as work positioning points to EN358 and sit positioning points to EN813. It is crucial that these attachment points are not used for fall arrest.

- A suitable fall arrest lanyard incorporating an energy absorber – this could be an energy absorber with integral lanyard conforming to EN355 or, where supplied separate, a fall arrest lanyard conforming to EN354 fitted with a compatible energy absorber conforming to EN355. In these configurations the fall arrest lanyard including energy absorber part, lanyard part and end connectors, must not exceed 2 metres. Other acceptable types of fall arrest lanyard include retractable type fall arrest lanyards conforming to EN360, or special energy absorbers supplied with EN353-1 or EN353-2 fall arrest systems.

- Suitable connectors conforming to EN362 to enable attachment of lanyards to harnesses and anchor points (PPE lanyards are often supplied fitted with an option of end connectors).

- A suitable structural anchor point – should the structural anchor point be deemed unsuitable to enable direct fixing of the connector, it may be necessary to install a PPE anchor device conforming to EN795 as an interface between the structure and lanyard.

Anchor points used for fall arrest applications must be strong enough to withstand the required static and dynamic loads resulting from a fall. The PPE manufacturer should advise the strength requirements for the anchor point to accommodate the specific PPE.

It is essential that workers are adequately trained and competent to ensure safe use of the intended fall arrest equipment.

7.10.5 Selection and control of PPE structural anchor points

It is essential that structural anchor points are validated as fit for purpose for the specific PPE and work requirements. This means validation that they are strong and stable enough to support the static and dynamic loads encountered under normal use and where applicable, during falls, and that they are compatible with the PPE attached to them. The PPE manufacturer's user instructions should detail the strength and requirements of the structural anchorage required to locate the specific PPE.

Every effort should be made to ensure, where possible, that the structural anchor point is located above the attachment point of the user harness, in order to minimise the severity of falls, i.e. fall distances and subsequent fall arrest forces.

When selecting anchor points for fall arrest applications it is vital to ensure the free space below the anchor point is sufficient to prevent the user hitting the ground or colliding with other obstacles in the fall path. The available space below the anchor point may determine the type of PPE selected. The space required below the worker is based on a combination of factors including user weight, height, free fall distance, extension, deformation and deployment of PPE, and harness stretch. The PPE manufacturer should be able to provide guidance on the free space required below the worker to accommodate the specific PPE.

When selecting suitable structural anchor points, consideration should be given to potential hazards which may endanger the worker or work equipment during normal use or under fall conditions. Comments on some typical hazards are given below:

- Anchor points and surrounding structure should be free of burrs, abrasive surfaces and sharp edges to prevent wear and lacerations of PPE textiles
- The fall path should be clear of any obstructions
- The area should be checked for electrical cables
- The danger of pendulum falls should be considered

It is essential that PPE is attached in a correct manner to the anchorage point, as instructed in the manufacturer's PPE user instructions. For example, if a PPE lanyard or anchor strap is choked around a structure, it is important that the manufacturer has approved the PPE for this method of attachment.

Anchor points should be identified and controlled; this includes inspection by workers before use, in addition to regular periodic inspections by a competent person. This is paramount in ensuring that the integrity of anchor points and safety of PPE, especially in an outdoor environment where structures are more prone to corrosion and environmental hazards.

7.10.6 Installation of PPE

It is important that where PPE systems require specialist installation, the installer is authorised by the PPE manufacturer and that the installation is carried out in compliance with the PPE manufacturer's instructions.

Where specialised installation is not deemed necessary for PPE, it is essential that persons responsible for installing it are competent and adhere to the manufacturers instructions; this includes anchoring of lanyards, lifelines and connectors.

Horizontal fall arrest systems should only be installed within the geometric limits specified by the manufacturer, as instructed in the PPE installation and user instructions and as agreed by the notified body in the CE Approval Certificate. This is normally horizontal or near to horizontal.

Vertical fall arrest systems should only be used within the geometric limits specified by the manufacturer, as instructed in the PPE installation and user instructions and as agreed by the notified body in the CE Approval Certificate. This is normally vertical or near to vertical.

Harnesses should be donned and detached as instructed by the manufacturer within the user instructions, and should be a secure and comfortable fit, with proper adjustment to enable the correct positioning of the harness attachment points relative to the user. This will enable a safe mode of arrest with the correct fall posture, distributed loads and security.

7.10.7 Compatibility of PPE

It is essential that components of a PPE system are not interchanged and mixed with other PPE components, unless authorised by the PPE manufacturer. Mixing and altering PPE can have serious effects with potentially disastrous consequences, where the functioning of the one system can be hindered by the action of another.

The following should be avoided at all times:

- Connecting in series EN355 energy absorber lanyards to EN360 retractable type fall arresters or other system energy absorbers
- Connecting in parallel two EN355 single leg energy absorber lanyards to the same anchor point
- Adding karabiners and connectors to fall arrest energy absorber lanyards, thus exceeding the maximum intended length
- Substituting the lanyards of EN353-1 and EN353-2 fall arrest systems
- Connecting EN360 retractable type fall arresters to flexible EN795 class C horizontal lines
- Connecting EN360 retractable type fall arresters to EN795 class E deadweight anchors
- Using the wrong types of connectors on lanyard terminations

- Changing the rope and wire specifications on sliding chuck type fall arrest systems i.e. EN358 rope grabs, EN353 fall arrest systems and EN795 class C horizontal systems

- Using a different type of harness and attachment point from that specified by the manufacturer

- Substituting the PPE system fixings, clamps and anchors

7.10.8 PPE training, awareness and competence

Fall protection PPE must only be used by trained and competent personnel and in conjunction with an effective rescue plan in the event that a fall should occur.

Training should only be provided by competent persons who fully understand the equipment and work techniques involved. A large number of training providers now exist within the UK, including a number of PPE manufacturers. However, it is unfortunate that no mandatory certification scheme currently exists within the UK to control the competence of training providers within this highly specialised area. There is, however, a UK body, HASG (Height & Access Safety Group) which is a technical product group comprising UK manufacturers and suppliers. The aim of the group is to promote best practice for organisations which provide training or education in the use of PPE and collective protection equipment for work at height or rescue, and the group enables members to be kept up to date with current legislation, techniques and equipment. Other organisations may exist which also assess and determine the competence of such providers.

It is essential that the manufacturer's PPE user instructions are read, understood and retained, since these provide vital information relating to the intended use of the PPE, its limitations, relevant warnings, inspection procedures, storage requirements and cleaning. The PPE user instructions should be used as an aid in the preparation of work procedures regarding inspection, training and maintenance.

In order to assess the competence of staff working at height, workers should be under continued supervision with a record being kept of training and competence levels.

7.10.9 Inspection, care and maintenance of PPE

It is important that PPE is properly cared for and maintained to ensure its continued safety and reliability. Relevant issues include record keeping, general use, inspection, periodic examination, servicing, repair, cleaning and storage.

7.10.9.1 Record keeping for PPE

Records should be kept and maintained for all PPE components including systems and subsystems. The records should include the following information:

- PPE type and model

- Means of identification i.e. batch or serial number

- Manufacturer/supplier details
- Date of purchase
- Date of manufacture
- Expiry date
- Date first put into use
- Maintenance requirements (i.e. inspection, examination, servicing, storage)
- Maintenance records covering inspections, examinations, servicing and repairs. The records should include dates, name and signature of the competent person who carried out the maintenance.

7.10.9.2 General use of PPE

It is essential that PPE is properly looked after during general use to prevent damage and wear which may hinder the safe operation or reduce the strength of the equipment.

Special care should be taken to avoid poor storage, dragging and scuffing of equipment, and using equipment in contact with sharp edges, abrasive surfaces, oil, water and other contaminants and chemicals. Special care should also be exercised to protect PPE from direct sunlight, temperature effects, knotting, abrasive surfaces, cutting, contaminants, chemical reagents and climatic conditions.

Special care should be taken when using fall arrest devices, particularly retractable types or those which operate with fall arresters sliding on a wire, rope or rail, to avoid soiling from oil, which can act as a lubricant and greatly affect the ability of the fall arrester to stop.

It is imperative that users are aware of the potential hazards and risks associated with the specific PPE to avoid actions of neglect and abuse.

7.10.9.3 Pre-use inspection of PPE

PPE should be inspected and checked by a competent person prior to each occasion of use. The manufacturer's user instructions should provide guidance on pre-inspection and equipment checks.

PPE should be withdrawn from use if damage is evident or if there is any doubt about the integrity and safety of the equipment.

Pre-use inspections, although often not as thorough as periodic examinations, can highlight a number of concerns which may affect the safety of the PPE. Typical checks and observations include but are not limited to the following:

- Checks for the expiry dates of PPE
- Checks for abrasion, wear and cuts

- Checks for cracks and deformation of parts
- Checks for damaged stitching
- Checks for loose fixings
- Checks for signs of falls (i.e. parted/deployed equipment, fall indicators)
- Checks for contaminants (i.e. oil, water, dirt, paint)
- Checks for discolouring
- Checks for heat damage
- Checks for corrosion
- Checks for knots
- Checks for ill fitting parts (ensure that connectors and buckles close and lock properly)

7.10.9.4 Periodic inspection/examination of PPE

It is important that all PPE used for fall protection is subjected to regular periodic inspection/examination by a competent person in accordance with the manufacturer's requirements as stated in the PPE user instructions. This is normally required at least once every 12 months. However, dependent on the equipment, frequency of use, and conditions, inspection/examination may be required on a more frequent basis.

For certain types of PPE, inspection/examination may only be permitted by the manufacturer or by a competent person authorised by the manufacturer.

A record should be kept of all periodic inspections/examinations.

7.10.9.5 Servicing and repair of PPE

Servicing and repair of fall protection PPE must only be carried out by the manufacturer or by a competent person authorised by the manufacturer.

A record should be kept of all servicing and repairs.

7.10.9.6 Cleaning of equipment

Care should be taken when cleaning PPE where certain chemicals and cleaning detergents can often harm and degrade the equipment. It is essential that PPE is cleaned only as advised by the manufacturer within the PPE user instructions.

Drying of PPE should be done naturally away from direct heat.

7.10.9.7 Storage of PPE

PPE should be stored as advised by the manufacturer in the user instructions, which for textiles usually requires storage in a cool dry place, out of direct sunlight.

7.10.9.8 Disposal of PPE

It is essential that PPE is disposed of when deemed unsuitable for use and where repair is not possible or recommended by the manufacturer.

PPE should be disposed of before the expiry date or lifetime stated by the manufacturer. This is regardless of the condition of the PPE and the frequency of use, because textiles can naturally degrade and weaken without obvious signs. The maximum lifetime for textiles is usually stated as 5 years. However, this may decrease drastically dependent on the conditions and frequency of use.

It is essential that PPE is withdrawn from service immediately after a fall and if unserviceable disposed of in the correct manner.

7.10.9.9 Rescue Plans

It is important that an effective rescue plan is in place to enable the speedy and safe recovery of falls victims in the event that a fall should occur. The rescue plan should also deal with the causes, effects and consequences of suspension trauma and take the necessary steps to prevent and minimise. The plan should address a range of issues:

- Fast response plan to emergency situation (i.e. no lone working and provisions for raising alarm and seeking medical aid)
- Comfortable harnesses to prevent strangulation of arteries
- Adequate rescue training of staff by a competent person to enable a safe and speedy rescue
- Leg loops and aids to enable the workers legs to be brought to an upright position to aid the flow of blood
- Encouragement of worker movement to aid circulation, where workers should be trained to pump the leg muscles frequently to reduce the risk of venous pooling.
- Continuous monitoring for symptoms of suspension trauma
- Awareness of first aid and medical requirements post trauma, which may require resuscitation and hospitalisation.

Guidance in suspension trauma is recommended in HSE Research Report No. 451/2002[19] Harness Suspension.

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