

## **APPENDIX 2**

### **COMPARISON OF RESULTS BY RIDE TYPE**

## **INTRODUCTION**

The following tables detail and compare the range of fall protection equipment observed on the main rides and entertainments where working at height played a major role in assembly, dismantling or inspection activities.

Although most fairground rides are unique, for reporting purposes rides and entertainments have been categorised into various groups, depending on the working at height activities involved. Some rides may fall into a number of groups, where for example they could comprise both vertical and sloped structures. Examples of ride types, as included in the categories below, are identified in Appendix I.

As many PPE systems can only be installed following the build of the fairground, the fall protection methods used during the build and dismantling of rides may differ to those used during the routine inspection of fixed rides.

Any specified good practice and recommendations within are subject to the suitability of the ride and work tasks involved, determined for each ride case by case using risk assessment.

Recommendations for the use of fall protection, does not override the hierarchy requirements of avoidance, prevention and mitigation against falls from height, where, every effort should be made to avoid working at height by exploring other possible methods. Where fall protection equipment is required to minimise the consequences of a fall, collective protection should be considered before personal protective equipment.

ROLLER COASTERS														
Ride Type & Activity	Number of rides reviewed	No Fall Protection	MEWP	Elevating work platform	Suspended man-riding cradles	Single leg fall arrest lanyard	Twin leg fall arrest lanyard	EN353-1 fall arrest system	EN795-C fall arrest System (Horizontal)	EN360 Retractable fall arrester	Mobile scaffold towers	Safety nets	Soft landing mats	General Comments
Travelling (Build and Dismantle)	7		●			●	●	●						<ol style="list-style-type: none"> <li>1) Some rides used only a single leg fall arrest lanyard which provided no protection when changing positions.</li> <li>2) Some rides had no fall protection in use when climbing vertical pillars.</li> <li>3) Some rides used twin leg fall arrest lanyards, which provided greater protection ensuring permanent attachment at all times.</li> <li>4) Some rides used EN353-1 fall arrest systems fixed to vertical pillars.</li> <li>5) The use of MEWPs was limited.</li> </ol> <p><b>Best Practice</b> The use of EN353-1 fall arrest systems fitted to vertical pillars in conjunction with twin leg energy absorber lanyards provided the maximum fall protection, ensuring safe entry and exit and transfer between positions. The advantage of using the EN353-1 system while climbing ladders, is that the EN353-1 system provides a controlled and limited fall and enables the worker to climb using both hands. Alternative fall arrest systems equally as effective while climbing vertical pillars include EN360 retractable type fall arresters and EN353-2 flexible fall arrest systems (which are simply suspended from an overhead attachment without the need for complex permanent fixing).</p> <p>Consideration should be given to the need for work positioning and restraint equipment to aid the positioning of the worker during tasks and to prevent workers reaching open edges.</p> <p>Consideration should also be given to the use of temporary horizontal safety lines conforming to EN795 Class B, which it may be possible to install between two stable uprights to provide workers with an overhead anchor point, to minimising the severity of falls and fall obstructions.</p>
Fixed Rides (Inspection)	10	●	●			●			●					<ol style="list-style-type: none"> <li>1) The use of MEWPs was limited due to space, access and terrain.</li> <li>2) A large number of rides had no effective fall protection, and workers were at risk from falling off open edges and through open floors.</li> <li>3) An EN795 Class C horizontal system was observed fitted to steep inclines.</li> </ol> <p><b>Best Practice</b> Roller coasters mainly comprise a mixture of structures including vertical, horizontal and inclined. In order to fully address all safety risks, a combination of PPE systems may be required in addition to suitable fall arrest lanyards, including: EN353-1 vertical, EN795-C horizontal, inclined safety systems. Every effort should first be taken to provide suitable walkways with non-slip treads, adequately enclosed edge protection barriers and closed floors to prevent falls from occurring.</p> <p>Consideration should be given to the need for work positioning and restraint equipment to aid the positioning of the worker during tasks and prevent accessing open edges.</p>

VERTICAL RIDES														
Ride Type & Activity	Number of rides reviewed	No fall Protection	MEWP	Elevating work platform	Suspended man-riding cradles	Single leg fall arrest lanyard	Twin leg fall arrest lanyard	EN353-1 fall arrest system	EN795-C fall arrest system (Horizontal)	EN360 Retractable fall arrester	Mobile scaffold towers	Safety nets	Soft landing mats	General Comments
Drop Towers (Build & Dismantle)	2			●		●								<ol style="list-style-type: none"> <li>Workers utilised the passenger shuttle as an elevating work platform.</li> <li>One ride erected fully enclosed guardrails around the work platform to prevent workers accessing open edges.</li> <li>The work platform on the second ride had no side enclosures and open corners on the floor – workers were protected using a single leg fall arrest lanyard.</li> </ol> <p><b>Best Practice</b> The recommended practice for such rides is to install guardrails around the elevating work platform at ground level before elevation and to ensure the floor is closed off to prevent falls occurring. Any use of fall arrest PPE should be carefully considered due to potential hazards and fall obstructions. Lanyards may be in danger of cutting and failing when loaded over the platform edge during a fall. Fall arrest lanyards should be attached to suitable anchor points on the elevating platform only with anchoring to the main tower structure (non moving part) avoided.</p>
Drop Towers (Inspection)	2			●		●		●						<ol style="list-style-type: none"> <li>Both rides were fitted with EN353-1 fall arrest systems fitted to the inside ladders.</li> <li>In addition one ride utilised a temporary enclosed work platform, which could be fitted to the existing passenger shuttle at one outer side. A full permanent working platform could also be erected around all four outer sides of the passenger shuttle, when required.</li> </ol> <p><b>Best Practice</b> Best practice is dependent on the nature and access requirements for the work to be carried out. In instances where the elevating passenger shuttle is used as a working platform, all measures should be taken to ensure that no open edges or open floors are accessible.</p>
Windmill Type (Build, dismantle and inspection)	6				●									<ol style="list-style-type: none"> <li>Most vertical windmill type rides utilised suspended cradles to enable safe working at height.</li> <li>Some workers did not wear fall arrest PPE while inside the cradles.</li> </ol> <p><b>Best Practice</b> Suspended cradles fitted with full enclosures provide a safe working platform. It is important that fall arrest PPE is used and attached to a suitable anchor point in the cradle if the worker is required to lean out of the cradle to conduct the necessary work.</p>

Cable Car Towers (Inspection)	5	●																	<p>1) A number of cable car towers spanning over 9 metres high were not fitted with adequate protection, with an absence of rest landings, ladder safety hoops and fall arrest systems.</p> <p>2) The upper gantry on a number of towers lacked either adequate enclosures to prevent accessing open edges or suitable anchorage points to allow attachment of PPE.</p> <p><b>Best Practice</b> Ladders exceeding 9 metres high should be fitted with rest landings and ladder safety hoops. Ideally ladders should be fitted with suitable fall arrest systems to provide maximum protection. Where work is performed on upper gantries, the platform should be adequately enclosed. Where full enclosure of the working area is not possible, suitable anchorage points should be installed to permit attachment of PPE.</p>
Bungee (Build)	1									●									<p>1) An EN360 retractable type fall arrester was used to provide fall protection to workers when climbing of almost vertical ladders and while working on adjacent platforms.</p> <p><b>Best Practice</b> EN360 retractable type fall arresters provide fall protection over large areas. The devices are normally available to cover most lengths, with a variety of lifeline materials including textile and steel. The built in absorbance feature provides a cushioned arrest during falls. Some devices are available with an integrated rescue winch, enabling a second person to retrieve falls victims.</p>

SLOPED RIDES														
Ride Type & Activity	Number of rides reviewed	No fall protection	MEWP	Elevating work platform	Suspended man-riding cradles	Single leg fall arrest lanyard	Twin leg fall arrest lanyard	EN353-1 fall arrest system	EN795-C fall arrest system (Horizontal)	EN360 retractable fall Arrester	Mobile scaffold towers	Safety nets	Soft landing mats	General Comments
Travelling & Fixed (Build, dismantle and inspection)	10	●				●		●						<ol style="list-style-type: none"> <li>1) A number of rides had no fall protection methods in place.</li> <li>2) Some rides used single leg fall arrest lanyards while climbing ladders and working on upper parts of the ride.</li> <li>3) EN353-1 fall arrest systems were frequently installed down the centre of sloped ladders and adjacent to the sloped ladders.</li> <li>4) Some rides were fitted with fully enclosed upper platforms.</li> <li>5) Some rides had no upper platforms, adequate hand-holds and foot-holds or anchorage points to allow the attachment of suitable PPE.</li> </ol> <p><b>Best Practice</b> Ideally, sloping fixed ladders should be fitted with fall arrest systems. However it is important the system is deemed suitable for the intended incline and hazards by the manufacturer and that it is installed correctly, normally on the ladder or directly adjacent to the ladder. This enables ease of use with the intended short lanyard supplied with the system and prevents the need for workers to attach longer incorrect lanyards to enable use of the system. Ideally enclosed platforms should be installed where work is required on upper parts of the ride. Where this is not possible, suitable foot-holds, hand-holds and anchorage points should be installed to enable attachment of PPE. Where fall arrest lanyards are required careful consideration should be given to the selection of single leg or twin leg.</p>

HELTER SKELTERS														
Ride Type/Activity	Number of rides reviewed	No fall protection	MEWP	Elevating work platform	Suspended man-riding cradles	Single leg fall arrest lanyard	Twin leg fall arrest lanyard	EN353-1 fall arrest system	EN795-C fall arrest system (Horizontal)	EN360 retractable fall arrester	Mobile scaffold towers	Safety nets	Soft landing mats	General Comments
Travelling (Build and dismantle)	4	●												<ol style="list-style-type: none"> <li>1) No rides were equipped with fall protection measures to protect workers during the assembly of the main structure and during installation of the outer chute.</li> <li>2) Unsecured, narrow, wooden planks were mainly used, which provided inadequate and unsafe working platforms.</li> <li>3) Workers were at risk from falling through open flooring.</li> <li>4) Workers were at risk from falling off open edges, especially while leaning over edges to man-handle items into position and using ropes in poor condition.</li> <li>5) No fall arrest PPE was in use to protect workers in the event of a fall.</li> </ol> <p><b>Best Practice</b> Working platforms should be secured, non-slip and provide sufficient space for workers to conduct the necessary tasks. Where possible floors should be closed using suitable methods i.e. flooring panels or safety nets. Barrier enclosures, where possible, should be installed to prevent workers accessing open edges. Safe methods should be in place to give workers access between floor levels. Collective protection such as safety nets and landing bags should be considered. Where applicable suitable fall arrest PPE should be used and attached to suitable anchorage points on the structure, to protect workers in the event of a fall.</p>

MINIATURE ROLLER COASTERS														
Ride Type & Activity	Number of rides reviewed	No fall protection	MEWP	Elevating work platform	Suspended man-riding cradles	Single leg fall arrest lanyard	Twin leg fall arrest lanyard	EN353-1 fall arrest system	EN795-C fall arrest system (Horizontal)	EN360 retractable fall arrester	mobile scaffold towers	Safety nets	Soft landing mats	General Comments
Travelling (Build & dismantle)	2	●									●			<p>1) One ride utilised an open sided mobile scaffold tower and folding ladders to provide access and work positioning during the build of the ride.</p> <p>2) The other ride made no use of mobile scaffold towers or ladders, so workers climbed and balanced on partly built frames.</p> <p><b>Best Practice</b> Work on miniature roller coaster rides is carried out at heights where fall arrest PPE would serve no purpose, where normally there is insufficient fall distance below the worker. In order to avoid falls occurring the use of folding ladders and mobile scaffold towers would prove beneficial; ideally the scaffold tower should be enclosed to prevent falling off open edges.</p>

FRAME BUILDING/ DISMANTLE														
Ride Type & Activity	Number of rides reviewed	No fall protection	MEWP	Elevating work platform	Suspended man-riding cradles	Single leg fall arrest lanyard	Twin leg fall arrest lanyard	EN353-1 fall arrest system	EN795-C fall arrest system (Horizontal)	EN360 retractable fall arrester	Mobile scaffold towers	Safety nets	Soft landing mats	General Comments
Small Frames (Build & dismantle)	12+													<ol style="list-style-type: none"> <li>1) The majority of small-scale frames were built at ground level with a small part of the work requiring the use of stepladders, usually for installation of top canopy hoods and display signs.</li> <li>2) Some ladders proved too short, resulting in workers over-reaching.</li> <li>3) Ladders were at times unsecured and unstable.</li> <li>4) Workers frequently carried items up ladders, which reduced visibility and required use of both hands.</li> </ol> <p><b>Best Practice</b> Folding ladders, when properly selected, secured and used, generally provide adequate means for assembling small sized frames.</p>
Large Frames (Build & dismantle)	12+													<ol style="list-style-type: none"> <li>1) Workers generally used folding ladders and single span ladders.</li> <li>2) Workers climbed and balanced on partly built framework, and also walked on top of canopy roofs.</li> <li>3) Some ladders proved too short, resulting in workers over-reaching.</li> <li>4) Workers frequently carried items up ladders, which reduced visibility and prevented the use of both hands when climbing.</li> </ol> <p><b>Best Practice</b> Climbing and balancing on partly built, unstable framework, should be avoided and consideration given to the use of mobile scaffold towers and suitable ladders. Consideration should also be given to the use collective PPE soft landing mats, which are used commonly in the domestic construction industry.</p>