



Elevating and Amusement Devices Safety Division	Ref. No.: 541/21
Amusement Devices Code Adoption Document - Amendment	Date: April 15, 2021

IN THE MATTER OF:

Technical Standards and Safety Act 2000, S.O. 2000, c. 16

- and -

Ontario Regulation 223/01
(Codes and Standards Adopted by Reference)

- and -

Ontario Regulation 221/01
(Amusement Devices)

Subject: Amusement Devices Code Adoption Document - Amendment 541/21

The Director for the purposes of Ontario Regulation 221/01 (Amusement Devices), pursuant to section 1 of Ontario Regulation 223/01 (Codes and Standard Adopted by Reference), provides notice that the Amusement Devices Code Adoption Document dated June 1, 2001, published by the Technical Standards and Safety Authority, is amended as follows:

- 1. All sections of the Amusement Device Code Adoption Document dated June 1, 2001 are hereby replaced with the following, and all previous amendments thereto are superseded:**
 1. The Amusement Devices Code Adoption Document - Amendment **541/21**, dated April 15, 2021 and published by the Technical Standards and Safety Authority, is hereby adopted.
- 2. This amendment is effective June 15, 2021.**

ORIGINAL SIGNED

Roger Neate.

Director, O. Reg. 221/01 (Amusement Devices), made under the *Technical Standards and Safety Act, 2000*

This Code Adoption Document amendment has been developed in consultation with the Amusement Devices Advisory Council and various industry stakeholders.



AMUSEMENT DEVICES CODE ADOPTION DOCUMENT AMENDMENT 541/21

April 15, 2021

**Elevating and Amusement Devices Safety Program
Technical Standards and Safety Authority**

Background

This *document* and the codes it adopts establish requirements and minimum standards for the design, manufacture, construction, modification, erection and dismantling, operation, inspection, testing, and maintenance of amusement devices and rides.

Pursuant to s. 1(1) of O. Reg. 223/01 (Codes and Standards Adopted by Reference) made under the *Technical Standards and Safety Act, 2000*, the “Amusement Devices Code Adoption Document” published by TSSA and dated June 1, 2001 (the “CAD”) forms a part of O. Reg. 221/01 (Amusement Devices).

CAD amendment 541/21 replaces previous CAD amendment 535-18.

Colour Coding and Reference Symbols Used in CAD Amendment 541/21

- 7.5** is a reference to another section in this CAD amendment
- (533/12)** is a reference to a predecessor document (Director’s Order, Enforcement Procedure, etc.)
- 7.2.4.** is a reference to a section in an external document or code

F2783 Standard Practice for Design is the ASTM format for identification of their standards

Note that definitions contained in O. Reg. 221/01 (Amusement Devices) apply to the CAD and adopted codes.

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**Amusement Devices
Code Adoption Document
Referenced in the Amusement Devices Regulation**

Part 1

1 GENERAL

1.1 Definitions

1.1.1 The terms in this Code Adoption Document (*Document*) have the same meaning as in the *Act* or the Regulation unless otherwise specified herein.

1.1.2 Where a provision of a code or standard adopted in this Code Adoption Document (*Document*) is inconsistent with the requirements of this *Document*, the provision of this *Document* shall prevail.

1.1.3 In this *Document*:

- (a) "**ASTM**" refers to the ASTM international "standards" organization that develops and publishes voluntary consensus technical standards;
- (b) "**ASME**" means American Society of Mechanical Engineers;
- (c) "**bungee assisted bounce**" means a device that creates a bouncing action using a trampoline or inflated pad to create a bouncing action that is further assisted by an elastic rope or metal rope and springs or by any other means to supplement the bouncing of a rider to a maximum height of 10m above the bounce surface;
- (d) "**bungee jump**" means a device that allows a rider to freefall from a height while attached to an elastic cord (bungee) which limits the rider's descent and allows for a recoiling action;
- (e) "**bungee ride**" means a device that uses elastic rope or metal rope and springs, or any other means used to create a launching and restraining action while propelling a rider in a horizontal or vertical direction or combination thereof;
- (f) "**critical component**" means a piece of equipment, structure or device that forms part of an amusement device where the failure of the component would likely result in a serious injury because of a fall or impact;
- (g) "**deropement**" means when a rope or cable leaves its operating position relative to the groove of a sheave, carriage wheel, or saddle;
- (h) "**F24**" is a reference to the ASTM committee that is responsible for the development of codes and standards related to Amusement Rides and Devices;
- (i) "**freefall descender**" means a device which permit riders to freefall for a duration of time before the device begins to impart a retarding motion on the rider;
- (j) "**lifeguard**" means a person who is the holder of
 - (i) the National Lifeguard Services Lifeguard Certificate, or

- (ii) a certificate that in the opinion of the director is an alternate acceptable certificate to that referred to in (i);
- (k) “**regulation**” except where otherwise specified, means Ontario Regulation 221/01 (Amusement Devices) made under the Technical Standards and Safety Act, 2000.

1.2 Referenced Documents

- 1.2.1 For undated references, the latest edition of the referenced document applies, except as modified by **3.1.3**.
- 1.2.2 For dated references, any subsequent amendments or revisions of these referenced documents do not apply, unless otherwise noted.

Part 2

2 GENERAL TECHNICAL REQUIREMENTS

2.1 Welding (533/12)

- 2.1.1 Welding and the qualification of welders shall be in accordance with the requirements set forth in ASTM F2783 Standard Practice for Design, Manufacture, Operation, Maintenance, and Inspection of Amusement Rides and Devices, in Canada.
- 2.1.2 Structural steel repairs and the method to repair a crack in a weld or the parent metal of structural steel on an amusement ride or device must be specified (provided or approved) by the manufacturer/designer of the amusement device. Where the manufacturer/designer no longer exists or is unavailable a Professional Engineer may fulfill these requirements. (533/12)
- 2.1.3 The requirement to non destructive test (NDT) a weld repair is generally determined by the manufacturer/designer and/or the engineer who specified the weld particulars utilizing their knowledge of the structure and stresses transmitted to the weld area. (533/12)
- 2.1.4 The maintenance records of an amusement ride or device need to include all supporting documentation related to repairs, including welding repairs. The owner shall ensure that welding repairs are done in accordance with the referenced standards, and may be asked to demonstrate compliance through documentation. (533/12)

2.2 Electrical

- 2.2.1 Electrical equipment shall conform to the requirements of the Ontario Electrical Safety Code as amended from time to time.

2.3 Building Code

- 2.3.1 A reference to the "building code" or to the National Building Code of Canada or "NBCC" in this *document* or in any codes referenced shall be deemed to refer to the Ontario Regulation 332/12 BUILDING CODE made under the Building Code Act 1992, as amended, commonly known as Ontario Building Code or "OBC".
- 2.3.2 Every platform, stair or ramp used in connection with an amusement device shall be designed and constructed in accordance with the applicable provisions of the building code.

2.4 Format of Technical Dossier Submissions

- 2.4.1 Technical dossiers shall be submitted in electronic format as follows:
- (a) filled specification sheets shall be provided in excel or PDF format;
 - (b) other supporting documentation shall be provided in unprotected PDF, excel or word format;

Note: electronically received documents will be returned electronically at the conclusion of the design review.

2.5 Pinned Connections

- 2.5.1 Where the failure of a single pinned connection that could create an unsafe condition on a part of an amusement device, a safety retainer shall be provided for that part of the amusement device that would be subject to the unsafe condition if the pinned connection failed.

2.6 Wire Rope Maintenance, Inspection and Replacement

- 2.6.1 Wire rope maintenance, inspection and replacement shall be as required by ASTM [F2783 Standard Practice for Design, Manufacture, Operation, Maintenance, and Inspection of Amusement Rides and Devices](#), in Canada (see [F2783-20](#) requirement [7.4.6](#)).
- 2.6.2 The requirements of ASME A17.6-17 Standard for Elevator Suspension, Compensation, and Governor Systems section 1.10 shall also apply for the evaluation and replacement of wire rope.

2.7 Rope Clips

- 2.7.1 Where clips are used to fasten the end of a wire rope,
- (a) the rope end shall be bent over a grooved heart-shaped thimble, the groove of which has a radius equal to that of the rope;
 - (b) the U-bolt section of each clip shall contact the dead end or short end of the wire rope;
 - (c) at least two clips shall be used where the wire rope is less than nine millimetres in diameter;
 - (d) at least three clips shall be used where the wire rope is nine or more but less than sixteen millimetres in diameter;
 - (e) at least four clips shall be used where the wire rope is sixteen or more millimetres in diameter;
 - (f) the clips shall be spaced at a distance apart equal to six times the rope diameter and not closer than four times the rope diameter from the short-end of the rope; and
 - (g) the nuts on the clips shall not be fully tightened until after the rope has been under load and all nuts shall be fully tightened while the rope is still loaded.

2.8 Chain Design

- 2.8.1 The factor of safety for link chain used on an amusement device shall be in accordance with ASTM [F2291 Practice for Design of Amusement Rides and Devices](#) (see [F2291-20](#) requirement [13.2](#)).
- 2.8.2 Where the safety of the passengers in a passenger carrying unit of an amusement device is dependent on a single link chain, a safety retainer shall be used together with the link chain.
- 2.8.3 Link chain that is used as a safety retainer or in a stress bearing application on an amusement device shall,
- (a) be certified by the chain manufacturer as to its load carrying capacity; and
 - (b) not be constructed of twisted wire or stamped chain.

- 2.8.4 Each fastener that is used with a link chain on an amusement device shall have a load carrying capacity that is at least equal to the link chain to which it is fastened.
- 2.8.5 Cold shuts, quick links, shackles, connecting links or open hooks shall not be added to the link chain that is used as a safety retainer or in a stress bearing application on an amusement device.
- 2.8.6 Subsection 2.9.5 does not apply to shackles or quick threaded links that are used as end fasteners on a link chain.

2.9 Chain Maintenance

- 2.9.1 A link chain that is used on an amusement device shall be replaced with a new link chain where,
- (a) the reduction in the original diameter of the material forming a link in the chain shall not exceed 10 per cent unless otherwise specified by the designer or manufacturer of the amusement device;
 - (b) a link is twisted or distorted;
 - (c) corrosion occurs in a link to a degree that affects the factor of safety required for the link chain;
 - (d) the link chain is used for a purpose other than that for which it is intended to be used; or
 - (e) the link chain is used to carry a load in excess of its capacity.

2.10 Fencing, Guards and Clearances

- 2.10.1 Where required, fencing shall be in accordance with ASTM F2291 Practice for Design of Amusement Rides and Devices (see F2291-20 section 14), except as otherwise allowed or required by the building code (see 2.3).
- 2.10.2 Fencing that will prevent a person from falling shall be provided for each amusement device where it is possible for a person to fall more than 600 millimetres off a platform.
- 2.10.3 Fencing that will prevent access to the amusement device shall be provided for each amusement device where it is possible for persons other than those authorized by the operator or licensee to have access to an area where,
- (a) parts of the amusement device are moving at a speed that exceed 8 kilometres per hour or seven revolutions per minute;
 - (b) any part of the amusement device or passenger swings out over an area to which the public has access less than 2.5 metres above ground level;
 - (c) the normal operational mode of the amusement device is potentially hazardous to bystanders; or
 - (d) guy wires or braces are used on the amusement device that are not clearly marked with streamers or other similar devices.
- 2.10.4 Each opening to an amusement device that provides entrance to or exit from the amusement device for the public shall be provided with a means of preventing persons from inadvertently entering the device.
- 2.10.5 Where fencing is required under this section, the fencing shall be at least 750 millimetres from any moving part of an amusement device.

- 2.10.6 Every mounting, drive mechanism, structure or other component of an amusement device that could entangle a part of a passenger or the clothes of a passenger shall be guarded to prevent injury to a passenger.
- 2.10.7 Where two or more amusement devices are adjacent to one another and the public is authorized access between the amusement devices, each amusement device shall be so placed that between a part of an amusement device that is not fenced and
- (a) a moving part of an adjacent amusement device there is a space of at least four metres; or
 - (b) a fixed part of an amusement device or a fence around an adjacent amusement device there is a clear space or walkway of at least three metres.

2.11 Support and Blocking

- 2.11.1 Bricks or cement blocks shall not be used to support and block an amusement device.
- 2.11.2 Subsection [2.12.1](#) does not apply to the use of bricks or cement blocks to support and block a platform, stair or a ramp that forms part of an amusement device but is structurally independent from the amusement device.
- 2.11.3 Blocks, other than brick or cement blocks, that are used in the construction of an amusement device shall, where the blocks are more than two tiers high, be cribbed or crossed.
- 2.11.4 Where only one or two tiers of blocks are used in the construction of an amusement device, the height of the blocking shall not exceed the total width of the base of the blocks being used.
- 2.11.5 Blocking that is used in the construction of an amusement device shall be sized so that the bearing surface of the blocking is at least equal to or greater than the bearing surface of the support pad of the amusement device.

2.12 Staking or Anchoring of Inflatables

- 2.12.1 All existing inflatable devices shall meet the criteria for staking or anchoring systems referenced in ASTM [F2374 Inflatable Amusement Devices](#) (see [F2374-19](#) section [5.6.8](#)).

2.13 Accommodation of Riders

- 2.13.1 Where a dossier specifies eligibility requirements that must be satisfied for the rider to partake in the amusement device experience, the criteria shall be based on a riders ability or on particularized attributes a rider must have that are deemed necessary for the device to be used safely.
- 2.13.2 Where the specified eligibility requirements appear to be a proxy for a different skill, ability, or rider attribute, the designer or engineer shall enhance the dossier details to demonstrate that reasonable efforts have been made to facilitate other forms of rider accommodation.

2.14 Environmental Analysis

- 2.14.1 An environmental analysis shall be conducted for all new amusement rides and devices.
- 2.14.2 The analysis shall consider the intended amusement ride or device environmental conditions during fabrication, construction, commissioning, setup/teardown, operation, transportation, and storage.

2.15 Aging Ride or Device Assessment

2.15.1 Where an aging assessment is required of an amusement ride or device, the assessment shall follow the recommendations of:

- (a) the manufacturer or a professional engineer if the manufacturer is no longer in business;
- (b) the requirements of any applicable code referenced in ASTM [F2783-17 Standard Practice for Design, Manufacture, Operations, Maintenance, and Inspection of Amusement Rides and Devices, in Canada](#); and
- (c) any additional requirements in an aging ride or device guideline set forth by the Director.

Part 3

3 AMUSEMENT DEVICES

3.1 Applied Code

- 3.1.1 Every new amusement device and alterations to existing devices shall comply with the latest edition of ASTM F2783 Standard Practice for Design, Manufacture, Operations, Maintenance, and Inspection of Amusement Rides and Devices, in Canada, and any changes set out in this *document*.
- 3.1.2 At the time of adoption of AD CAD Amendment 541/21, the following standards were referenced by ASTM F2783-20 Standard Practice for Design, Manufacture, Operations, Maintenance, and Inspection of Amusement Rides and Devices, in Canada:

Core, Supporting and Other Standards

- (a) F747 Terminology Relating to Amusement Rides and Devices
- (b) F770 Practice for Ownership, Operation, Maintenance, and Inspection of Amusement Rides and Devices
- (c) F1193 Practice for Quality, Manufacture, and Construction of Amusement Rides and Devices
- (d) F2291 Practice for Design of Amusement Rides and Devices
- (e) F2974 Guide for Auditing Amusement Rides and Devices
- (f) F1957 Test Method for Composite Foam Hardness - Durometer Hardness
- (g) F2137 Practice for Measuring the Dynamic Characteristics of Amusement Rides and Devices
- (h) F2375 Practice for Design, Manufacture, Installation and Testing of Climbing Nets and Netting/Mesh used in Amusement Rides, Devices, Play Areas and Attractions
- (i) F3214 Practice for Characterization of Fire Properties of Materials Specified for Vehicles Associated with Amusement Rides and Devices
- (j) F1159 Practice for Design of Amusement Rides and Devices that are Outside the Purview of Other F24 Design Standards

Ride Specific Standards

- (k) F2007 Practice for Design, Manufacture, and Operation of Concession Go-Karts and Facilities
- (l) F2374 Practice for Design, Manufacture, Operation, and Maintenance of Inflatable Amusement Devices
- (m) F2376 Practice for Classification, Design, Manufacture, Construction, and Operation of Water Slide Systems
- (n) F2460 Practice for Special Requirements for Bumper Boats
- (o) F2959 Practice for Aerial Adventure Courses
- (p) F2960 Practice for Permanent Amusement Railway Ride Tracks and Related Devices
- (q) F3054 Practice for Operations of Amusement Railway Rides, Devices, and Facilities
- (r) F3158 Practice for Patron Transportation Conveyors Used with a Water Related Amusement Ride or Device
- (s) F2461 Practice for Manufacture, Construction, Operation, and Maintenance of Aquatic Play Equipment
- (t) F2970 Practice for Design, Manufacture, Installation, Operation, Maintenance, Inspection and Major Modification of Trampoline Courts
- (u) F3099 Practices for Parasailing
- (v) F3133 Practice for Classification, Design, Manufacture, Construction, Maintenance, and Operation of Stationary Wave Systems

Note: Not all Ride Specific standards referenced in F2783 are applicable in Ontario. Refer to Ontario Regulation 221/01 for the definition of amusement device and a list of exemptions from that Regulation.

- 3.1.3 The edition of the standards listed in 3.1.1 and 3.1.2 are subject to re-affirmation or renewal as a part of ASTM Committee F24's on-going standards maintenance. Where a standard practice listed in 3.1.1 and 3.1.2 is re-affirmed or updated, the requirements of the new standard shall come into force six months after the standard's date of publication. Where the date of publication only refers to a month, the date of the month shall be deemed to be the 1st day of month.
- 3.1.4 Where a submission is being made in accordance with Ontario Regulation 221/01 s.9, the technical dossier shall include a listing of the applicable code(s) and their edition(s) [Publication Dates], that were used for this purpose.

3.1.5 For the purpose of [3.1.4](#), the latest code edition may be referenced prior to coming into force as specified in requirement [3.1.3](#).

3.2 Additional requirements

3.2.1 Every *operator* of an existing amusement device shall comply with the requirements of

(a) ASTM [F2783 Standard Practice for Design, Manufacture, Operations, Maintenance, and Inspection of Amusement Rides and Devices, in Canada](#), section 7; and

(b) the applicable requirements of [Part 2](#).

3.2.2 Where the manufacturer or designer of an amusement device is out of business, every person who operates such an amusement device shall comply with subsection [3.2.1](#) by obtaining the necessary information utilizing either internal or external expertise. See also ASTM [F2783-20 Standard Practice for Design, Manufacture, Operations, Maintenance, and Inspection of Amusement Rides and Devices, in Canada](#) requirement [5.4.3](#).

3.2.3 In addition to the requirements of subsections [3.2.1](#) and [3.2.2](#), every person who operates that amusement device shall assemble and maintain updated documents that shall include the following:

(a) all instructions, bulletins or other information issued by manufacturers, designers, the designated administrative authority and other safety or regulatory authorities that are applicable to the amusement device; and

(b) all additional instructions based on requirements in Ontario Regulation 221/01 that are related to installation, operation, inspections, testing, maintenance, and repairs of the amusement device.

3.2.4 In addition to the requirements of Ontario Regulation 221/01, where an amendment or change is required to be made to a technical dossier, the dossier submission documents shall comply with any relevant Directors' Guidelines.

Part 4

4 GO-KARTS

4.1 Kart Design

4.1.1 Except as set out in (a) and (b), the speed of every kart shall be inherently limited or governed so as not to exceed the maximum speed for which the track is designed:

(a) The speed of an *adult kart* shall be limited or governed so as not to exceed 45 km/h (30 mph),

(b) The speed of a *kiddie kart* shall be limited or governed so as not to exceed 16 km/h (10 mph).

4.1.2 Karts shall have brakes that are designed and adjusted to enable it to slow down and stop the kart when travelling its maximum speed, within twelve metres when carrying a driver weighing the maximum-rated load.

4.1.3 The brake and throttle controls on a kart shall return automatically to a non-operational position when released.

4.1.4 The seat belt assembly shall incorporate as a minimum a pelvic restraint and upper torso restraint.

4.2 Operation and Use

4.2.1 Refuelling of karts shall be carried out at a location that is inaccessible to the public at the time of refuelling.

4.2.2 Only a rider who is wearing a helmet that fits the rider's head and that meets the requirements of Regulation 610 of the Revised Regulation of Ontario, 1990 (Safety Helmets) made under the *Highway Traffic Act*, may use a kart.

4.2.3 Every go-kart shall have a sign posted to capture all items listed in ASTM [F2007 Practice for Design, Manufacture, and Operation of Concession Go-Karts and Facilities](#), (see ASTM [F2007-18](#) section [6.10](#)), including the following additional items:

(a) Approved helmets must be worn;

(b) Hair longer than shoulder length and loose clothing shall be secured; and

(c) Riders who are not substantially protected by the rollover protective structures shall be prohibited from riding the kart.

4.2.4 Procedures shall be in place to prohibit / prevent persons from walking between go-karts in the pit area used for loading and unloading go-karts.

Part 5

5 WATER SLIDES

5.1 Water Flow

- 5.1.1 All water slides shall be provided with either flow metered calibrated means of flow measurement or marker(s), to indicate proper operational water flow/levels for each flume as referenced in ASTM F2376 Water Slide Systems (see F2376-17a section 8.5.3).

5.2 Operation

- 5.2.1 The splash down area of each water slide shall be supervised by at least one *attendant* who is a *lifeguard* who shall have continuous and direct supervision of that area, except as permitted in 5.2.2.
- 5.2.2 Where the water depth of the splash down area does not exceed 1.10m (43.3 in), a lifeguard may be replaced by
- (a) a person sixteen years of age or over;
 - (b) the person has satisfied the operator that he or she is a competent swimmer;
 - (c) is trained in the emergency procedures for the pool; and
 - (d) is the holder of a current first-aid certificate as permitted in R.R.O. 1990, Reg. 565: Public Pools.
- 5.2.3 A run out area of each water slide shall be supervised as required by subsection 5.2.2 (a), (c) and (d).
- 5.2.4 Where the splash down area of a water slide forms an integral part of a swimming pool, a splash down area divider shall be in place between the splash down area of the waterslide and the rest of the swimming pool.

5.3 Identification

- 5.3.1 Each flume or consecutive flumes in a water slide arrangement shall be identified by a unique installation number.
- 5.3.2 Each unique installation number in a waterslide system shall have a separate logbook and shall be referenced as required for incident reporting purposes.
- 5.3.3 All multi-person water slide vehicles (rafts / tubes / boats) shall bear a serial number or a unique numbering system to label each unit for inspection and maintenance purposes.
- 5.3.4 All existing multi-person water slide vehicles shall conform to 5.3.3.

Part 6

6 BUNGEE JUMP, BUNGEE RIDE OR BUNGEE ASSISTED BOUNCE

6.1 Bungee Jump

6.1.1 The design and operation of every *bungee jump* shall comply with the requirements set forth in:

- (a) ASTM F1159 Standard Practice for Design of Amusement Rides and Devices that are Outside the Purview of Other F24 Design Standards;
- (b) any applicable requirements adopted by the standards listed in section 3.1 of this *document*; and
- (c) the “Canadian Bungee – Code of Safe Practice”. (Revision 04/07/00).

6.1.2 Bungee jumps shall be permanent, not portable installations.

6.2 Bungee Ride

6.2.1 The design and operation of every *bungee ride* shall comply with the requirements set forth in:

- (a) ASTM F1159 Standard Practice for Design of Amusement Rides and Devices that are Outside the Purview of Other F24 Design Standards; and
- (b) any applicable requirements adopted by the standards listed in section 3.1 of this *document*.

6.3 Bungee Assisted Bounce

6.3.1 The design and operation of every *bungee assisted bounce* shall comply with the requirements set forth in:

- (a) ASTM F1159 Standard Practice for Design of Amusement Rides and Devices that are Outside the Purview of Other F24 Design Standards; and
- (b) any applicable requirements adopted by the standards listed in section 3.1 of this *document*.

Part 7

7 ZIP LINES

7.1 Applied Code

- 7.1.1 Every newly installed or altered zip line shall conform to the requirements of [Part 1](#), [Part 2](#), [Part 3](#), and [Part 7](#) of this *Document*.
- 7.1.2 Zip lines shall comply with the requirements set forth in ASTM [F2959 Standard Practice Special Requirements for Aerial Adventure Courses](#).
- 7.1.3 The term *aerial adventure course* or *course*, in ASTM [F2959 Standard Practice Special Requirements for Aerial Adventure Courses](#), shall also mean *zip line*.

7.2 Definitions

For the purpose of [Part 7](#),

- (a) “**active brake**” means a brake or braking system that is initiated and/or sustained by the action of an *attendant* or the rider.
- (b) “**change over**,” means a manual transfer of carabiners or snap hooks from one activity or anchor point to the subsequent activity or anchor point by an *attendant* or rider, common in challenge courses or zip line/canopy tours.
- (c) “**connect/disconnect component**” means a component of a zip line or personal rigging system that is manipulated by an *attendant* or the rider during the action of preparing for, and completion of, riding. Connect/Disconnect components are intended for “quick” release and/or regular opening/closing, latching/unlatching and/or connection/disconnection.
- (d) “**gravity brake**” means a form of a passive braking system where the rider is brought to a stop by gravity.
- (e) “**loading or unloading area**” means the space, platform or structure within immediate proximity to the zip line where riders begin or terminate a zip line ride.
- (f) “**passive brake**” means a brake that is initiated and/or sustained without action of an *attendant* or the rider.
- (g) “**safety line**” means the flexible or rigid, horizontal, vertical or sloping, continuous or discontinuous device used as a protection against falling from a height.

7.3 General Requirements

- 7.3.1 All *critical components* must be accessible for inspection. Where special lifting equipment is required for inspections, this equipment shall be available at the time of all initial, follow-up or periodic inspections, as requested by the inspector or submitting engineer.

7.4 Clearance Envelope

- 7.4.1 In addition to rider Clearance Envelope Analysis required in ASTM F2959 Standard Practice Special Requirements for Aerial Adventure Courses (see F2959-19 requirement 11.), and section 6.6 of ASTM F2291, ziplines at their points of termination shall not be less than 2.0 metres apart, unless a risk analysis developed utilizing a comprehensive methodology can support a reduction of this dimension.
- 7.4.2 In addition to 7.4.1, the minimum vertical clearance between any part of the zip line and any part of an overhead system shall not be less than the following:
- (a) if the zip line crosses above a road or parking lot or any area with vehicular traffic, the lowest point of the rider, under the most adverse loading conditions shall be not less than 5.0 metres above the road.
 - (b) if the zip line crosses above a passenger ropeway, under the most adverse loading conditions including wire rope sag, stretch, and a *deropement* of the passenger ropeway, the lowest point of the rider will not pass closer than 2.4 metres from the highest point on the ropeway.
 - (c) if the zip line crosses underneath a passenger ropeway, the designer shall consider a complete *deropement* between the towers: no part of the ropeway shall come in contact with the zip line or rider under the most adverse loading conditions.
 - (d) Where a zip lines crosses over a hiking trail, walkway or ski slope, a vertical clearance of 2.4 metres shall be maintained from the lowest point of the rider under the most adverse loading conditions to the ground or snow level.

7.5 Towers, Platforms & Structures

- 7.5.1 Despite 2.3.2, small platforms (capacity less than or equal to four persons, no guardrails) shall:
- (a) be designed or evaluated by a professional engineer to be capable of supporting three times the rated capacity;
 - (b) be of sound construction and free of sharp edges or gaps that could pose hazards; and
 - (c) have suitable tie-offs or *safety lines*, capable of supporting the intended load, to facilitate the movement of *attendant(s)* while performing their required tasks including rescue.
- 7.5.2 Platforms, decks, or any structure that forms part of a zip line launch or landing platform shall have a conspicuously posted sign indicating Safe Working Load (capacity) in kg and number of persons.

7.6 Wire Rope

- 7.6.1 The entire length of the wire rope and all wire rope terminations must be visible for inspection.
- 7.6.2 Zip lines, shall be one continuous un-cut length of wire rope. i.e. no splices.

7.7 Guy Wires

- 7.7.1 Preventative measures shall be in place where a guy wire could be used, whether accidental, or deliberate, as a descent line.

7.8 End Terminations

- 7.8.1 Through bolted terminations of zip lines shall have a safety factor of 10 and shall be backed up with a system rated to eighty percent (80%) of the primary wire rope strength, and configured to protect against bolt and termination failure, not wire rope failure.
- 7.8.2 Turnbuckles, when used as part of the rigging of the zip line have a safety factor of 10 and shall be backed up with a system rated to eighty percent (80%) of the primary wire rope strength, and configured to protect against turnbuckle failure, not wire rope failure.

7.9 Brakes

- 7.9.1 Where the speed of the rider at approach to the unload platform is less than 10 km/hr, the zip line braking system shall consist of:
- (a) a primary brake that may be an *active brake* or a *passive brake*.
- 7.9.2 Where the speed of the rider upon the approach to the unload platform is greater than 10 km/hr and less than 24 km/hr, the zip line braking system shall consist of:
- (a) a primary brake which may be an *active brake* or a *passive brake*; and
 - (b) a secondary passive brake, except not a *gravity brake*.
- 7.9.3 Where the speed of the rider upon the approach to the unload platform is greater than 24 km/hr, the zip line braking system shall consist of:
- (a) a primary *passive brake*, except not a *gravity brake*; and
 - (b) a secondary *passive brake*, except not a *gravity brake*.
- 7.9.4 Brakes shall be engineered components of known design limits, and shall have a data tag that includes, or can be related back to a manufacturer's document that includes the following:
- (a) manufacturer's name, identification or designation;
 - (b) model, style, lot, or serial number;
 - (c) rope sizes permitted;
 - (d) speed limitations; and
 - (e) any additional safety requirements.

7.10 Personal Safety Equipment

- 7.10.1 All components that form part of a *safety line* or *critical component*, including but not limited to pulleys, trolleys, lanyards, slings, harnesses, helmets, or carabiners shall:
- (a) be permanently labeled by the manufacturer, such that the source of the equipment is traceable;

- (b) be commercially manufactured products used in personal rigging equipment application; and
- (c) bear the label of a certifying organizations or where the equipment is of a custom or unique nature a statement of equivalency shall be provided by the submitting engineer along with details of the test procedure.

7.10.2 In addition to **7.10.1**, all components that form part of a *safety line* or *critical component* such as pulleys, lanyards, slings, harnesses, helmets, or carabiners shall bear a serial number or a unique numbering system to label each unit or sets of units for inspection and maintenance purposes.

7.10.3 Where one or more parallel slings or lanyards are under tension, their lengths shall be varied or another method employed to minimize the risk of entrapment or strangulation.

7.10.4 In challenge course applications, where riders conduct repeated change-overs, auto-locking carabiners or snap hooks shall be used. Single action carabiners are not permitted.

7.10.5 Carabiners in *critical component* applications that are accessible to riders shall be a commercial grade, auto locking and triple action opening. All other carabiners shall as a minimum be double action.

7.10.6 Load-bearing locking carabiners, locking snap hooks or rapid links shall be made of steel where direct contact with the wire rope occurs during zip line riding.

7.10.7 Carabiners shall be of a size suitable for the equipment used.

7.10.8 All installations, including pre-existing installations, where repeated *change over* by the rider is required, *connect/disconnect components* shall be:

- (a) a continuous belay design or an interlocked belay design; and
- (b) include a secondary attachment not less than required in **7.10.4**.

7.10.9 For a single stand-alone zipline, where repeated *change over* is not required and where the launch platforms are staffed by an *attendant*, and the platform is not guarded by railings, gates or safety nets, the *connect/disconnect components*

- (a) may conform to **7.10.8**; or
- (b) shall utilize a means that offers not less than double lanyard protection with carabiners of a type not less than required in **7.10.5** when the rider is launching from the platform.

7.10.10 Harnesses shall:

- (a) be available to fit the range of rider sizes permitted on the zip line; and
- (b) offer full body harness protection, either as a full body harness or as a combination sit and chest harness arrangement to ensure the rider is retained regardless of rider orientation.

7.10.11 Helmets shall be worn by riders.

Note: The following standards are accepted for equipment identification as required above. Other standards may be used if acceptable to the director.

UIAA 104 Mountaineering and Climbing Equipment 'Slings'

UIAA 105 Mountaineering and Climbing Equipment 'Harnesses'
UIAA 121 Mountaineering and Climbing Equipment 'Connectors/Karabiners'
UIAA 106 Mountaineering and Climbing Equipment "Helmets"

EN 566:2006 Mountaineering equipment. Slings. Safety requirements and test methods.
EN 12277: 2015 Mountaineering equipment. Harnesses. Safety requirements and test methods.
EN 12275:2013 Mountaineering equipment. Connectors. Safety requirements and test methods.
EN 361:2002 Personal protective equipment against falls from a height. Full body harnesses.
EN 362:2004 Personal protective equipment against falls from a height. Connectors.
EN 1651:1999 Paragliding equipment. Harnesses. Safety requirements and strength tests.
EN 12492:2012 Mountaineering Equipment. Helmets for mountaineers. Safety requirements and test methods.

ANSI Z359 Fall Protection Code Version 3.0
CSA Z259.10-12 (R22016) Full body harness
CSA Z259.12-16 Connecting Components for Personal Fall-Arrest Systems (PFAS)
ASTM F1772-12 Standard Specification for Harnesses for Rescue, Safety, and Sport Activities

UIAA refers to Union International Alpinism Association
EN refers to European Norm
ANSI refers to American National Standards Institute

7.11 Hardware

- 7.11.1 The following requirements apply to all equipment used in a safety application such as connectors, pulleys, and shackles:
- (a) equipment shall have a product label stamped, engraved, or otherwise permanently marked with the product label information;
 - (b) load-bearing hardware shall display the mark or logo of the certification organization, and manufacturer's name or identifying mark; and
 - (c) load-bearing hardware shall display the minimum rated breaking strength, or a manufacturer's model number that relates back to a manufacturer's document that identifies the applicable strength ratings.
- 7.11.2 Shackles classified as *critical components* shall be commercial grade, and shall have a minimum breaking strength of not less than 100% of the minimum breaking force of the wire rope being used.

7.12 Zip Pulleys & Zip Trolleys

- 7.12.1 Pulleys/Trolleys identified in the technical dossier shall be supplied with the following documentation:
- (a) engineered drawings or manufacturer specifications indicating suitability of use;
 - (b) replacement, testing, and inspection criteria and intervals;
 - (c) rope sizes permitted;
 - (d) speed limitations; and
 - (e) any additional safety requirements.

- 7.12.2 Pulleys and trolleys or other dynamic *critical components* must be backed up in case of failure with a redundant connection between the rider and the zip line, where the safety factor of the pulley or trolley is less than twelve (12). The redundant system shall be at least eighty percent (80%) of the strength of the trolley or pulley.
- 7.12.3 Redundant lines for pulleys or trolleys, where required, shall attach to the zip line in parallel with the pulley. It may go through a part of the pulley, but the steel of the connector must be over the wire rope such that it would maintain suspension even in the event of a catastrophic failure of the pulley.
- 7.12.4 Despite subsection 7.12.2 where the pulley is placed on the rope by the rider or the *attendant*, (in applications such as challenge courses that utilize small lightweight pulleys), a redundant back up to the pulley is required regardless of the pulley safety factor.
- 7.12.5 Pulleys or trolleys shall be suitable as specified by their manufacturer for the size of wire rope being used, the maximum speed of travel, and of at least dual sheave construction.
- 7.12.6 Pulley sheave material shall be compatible with the wire rope.

7.13 Operational Requirements

- 7.13.1 Safety rules must be posted and explained to the rider prior to riding.
- 7.13.2 Challenge course or other zip lines where riders are more actively involved in their own connection/disconnection shall have a training area where a sample of a zip line is installed close to the ground. All riders shall be given an orientation prior to proceeding on to the challenge course or zip line. This training area will be used by *attendants* to assess the rider's ability and allow them to practice using the equipment, while allowing *attendants* to assess their ability to proceed.
- 7.13.3 Measures, whether equipment-related, procedural or both, shall be implemented to ensure that entanglements with hair, body parts, clothing or jewelry does not occur between the pulley or any other piece of equipment.
- 7.13.4 Means shall be in place to prevent riders from launching before they are properly attached to the pulley system.
- 7.13.5 Risk appropriate means shall be in place to prevent riders from launching before the zip line path is clear of obstructions.
- 7.13.6 If a fall hazard is present at the launch platform, riders must be tied off to an engineered fall restricting or fall arrest system, or riders shall otherwise protected by a system of guardrails, gates or safety nets.
- 7.13.7 Every zip line shall have a dedicated two-way voice communication system between *operators* (and/or *attendants*). Operation of the zip line shall cease if communication is not possible.
- 7.13.8 Zip line operations shall incorporate a means to avoid rider to rider collisions, or rider to mobile obstacle collisions (such as offloading ladders or scissor lifts) and in doing so shall meet one of the following conditions:
 - (a) The launch *attendant* shall have clear view of the zip line including the landing area. A procedure shall be in place to ensure that riders cannot be released before the zip line pathway is free of obstructions, or
 - (b) Where the launch *attendant* cannot see the landing area, where night operation is permitted, or where the span is such that visibility may be impeded by bad weather, direct sunlight or poor vision, another level of prevention shall be in place.

Note: Examples include a live video monitor of the unload area, bright warning lights visible in the worst weather conditions, an electronic/mechanical interlock that prevents the rider from launching when the object is out of the home or parked position or a combination thereof.

7.13.9 *Attendants* who operate scissor lifts or any other similar devices shall have documented formal training in compliance with the Occupational Health and Safety Act.

7.13.10 Zip lines that require a scissor lift or a similar mechanical lifting device as part of normal operation, such as loading or unloading, shall have a solid flat surface that has been engineered for the loads placed upon it.

7.14 Equipment Storage & Security

7.14.1 All equipment shall be stored according to the manufacturer's recommendations.

7.14.2 All equipment shall be securely stored with access restricted to authorized persons.

7.14.3 All unserviceable equipment shall be removed from the site.

7.15 Identification

7.15.1 Each zip line whether standalone or in a challenge course shall be identified by a unique installation number.

7.15.2 Each zip line shall have a separate log book and shall be referenced as required for incident reporting purposes.

Part 8

8 FREEFALL DESCENDERS

8.1 General Requirements

8.1.1 *Freefall descenders*, whether standalone or in a challenge course shall follow the applicable requirements of **Part 7** with respect to:

- (a) Towers, platforms and structures (see **7.5**);
- (b) Wire Rope if freefall descenders are suspended by wire rope (see **7.6**);
- (c) End Terminations (see **7.8**);
- (d) Personal Safety Equipment (see **7.10**);
- (e) Hardware (see **7.11**);
- (f) Operational Requirements (see **7.13**); and
- (g) Equipment Storage and Security (see **7.14**)

8.1.2 For the purpose of compliance with **8.1.1**, the term zip line in **Part 7** shall also mean *freefall descender*.

8.2 Harness to Freefall Descender Connection

8.2.1 Where riders are tasked with performing their own connect/disconnect to and from the freefall descender, the requirements of **7.10.8** apply.

8.2.2 For a single stand alone rides, where repeated *change over* is not required and where the launch platforms are staffed by an *attendant*, the *connect/disconnect components*:

- (a) may conform to **7.10.8**; or
- (b) shall utilize a means that offers not less than double lanyard protection with carabiners of a type not less than required in **7.10.5**.

8.3 Overhead mounting point of a Freefall Descender

8.3.1 As a minimum, freefall descender anchorage points shall be able to support a static load of 6kN (1,350 lbs) without exceeding the allowable unit stress of the materials used and with a safety factors of at least two (12kN or 2,700 lbs).

8.4 Impact Protection

8.4.1 Areas that the rider may come in contact with during descent and landing shall be padded or protected.

8.4.2 Surfacing in the landing area shall conform to the impact attenuation requirements in:

- (a) ASTM F1292 Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment; or
- (b) CSA Z614 Children's play spaces and equipment.

8.5 Identification

- 8.5.1 Each *freefall descender* whether standalone or in a challenge course shall be identified by a unique installation number.
- 8.5.2 Each *freefall descender* shall have a separate log book and shall be referenced as required for incident reporting purpose.