



Safe operation of passenger carrying amusement devices The Chair-O-Plane

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These Guidance Notes are published under five subject headings: Medical, Environmental Hygiene, Chemical Safety, Plant and Machinery and General.

INTRODUCTION

1 The Health and Safety Executive (HSE) published *The Code of Safe Practice at Fairs* in April 1984. It is the result of a joint initiative by HSE and the Associations* representing the fairground industry to improve safety standards at fairgrounds. The Code describes general principles and procedures required to safeguard operators, employees and members of the general public against injury from fairground amusement devices.

2 This Guidance Note describes various factors that can contribute to accidents on Chair-O-Plane rides and the precautions that should be taken to avoid them. It is intended for operators, ride attendants, and anyone else concerned with the safe operation of these rides.

3 The guidance is based on HSE reports and incidents, visits to fairgrounds by inspectors, and the considerable experience of fairground operators. The advice is not exhaustive and should be read in conjunction with the Code. However, compliance with this Guidance Note or the adoption of other equally effective measures will reduce the risk of accidents on these rides.

SCOPE

4 The Chair-O-Plane is a popular and traditional ride found at both fixed amusement parks and travelling fairs. All rides of this type operate on the same principle, and at the present time there are few variations in the basic design.

DESCRIPTION

5 The ride has a central tubular steel vertical column. From a central hub on the upper part of the column, 10 or more projecting radial arms fan out at regular intervals. Passenger carrying

*The British Association of Leisure Parks, Piers and Attractions
The Showmen's Guild of Great Britain
British Amusement Catering Trades Association

chairs are suspended by 4 chains or rods at different intervals along each arm, forming an inner and outer set of chairs. Spacers connect the outer end of each radial arm.

6 The weight of the upper structure and passengers is supported by tension members between the radial arms and an attachment spigotted into the central column. The lower part of the central column is supported by 4 inclined stay members bolted at the upper end to a support bracket, and at the lower end to bearers at platform level.

7 Motion is usually imparted to the central column by means of gearing and a belt drive from an electric motor. More modern versions of the ride are hydraulically driven; simpler versions can be hand and not power driven.

8 When the central column begins to revolve the passenger chairs move in a circular path around it and, as the speed increases, they move outward and upward by centrifugal force. On some rides, the radial arms can be raised and tilted hydraulically, with chairs reaching a height of 4.5m to 6m above the platform.

RISKS

9 The safe design and safe operation of the Chair-O-Plane ride should guard against the following risks:

- (a) fatigue failure of the central vertical column, particularly at the point of maximum stress in the vicinity of the main bearing;
- (b) failure of the radial arms, tension members, spacers and stays, due to failure to provide, maintain, or install adequate connections for these parts;
- (c) failure of supporting packing, either due to deterioration (e.g. wet rot in wooden bearers) or inadequate installation;
- (d) passengers being thrown from their seats while the ride is in motion.
- (e) injury to passengers, spectators, ride operators and attendants, who may be struck by the seats or by other passengers, when moving into or near the path of the moving parts of the ride;
- (f) injury to passengers within the seats.

DESIGN, MANUFACTURE AND MODIFICATIONS

10 The drive arrangements to the ride should be incapable of exceeding the maximum operating speed, which should be clearly marked at the controls of the ride.

11 The ride should be constructed or modified only after a full determination of the likely stress levels and fatigue life expectation of parts of the ride. This is particularly important in relation to the connections to the main vertical column, and the quality of welding carried out at such parts as the main bearing.

12 Adequate bolting and connecting arrangements should be made where bracing is provided between the tie rods and radial arms, and at the connecting points to the supporting stay members.

13 Connecting pins manufactured to join the structural members together should be of proper design and construction.

SITING AND LOCATION (PARAGRAPHS 110 - 115 OF THE CODE)

14 Before the Chair-O-Plane is erected, the site should be checked to ensure that it is level and is of sufficient size both to accommodate the ride safely and to allow sufficient clearance between the ride and adjacent devices. The site should be checked to ensure that it is not crossed by overhead electricity lines. The Chair-O-Plane should not be sited near overhead lines, which may endanger passengers in the cars, or anyone involved in erecting or dismantling the ride. Operators should not assume that a gap between the structure of the ride and high voltage overhead powerlines is always a sufficient precautionary measure, since electricity at high voltage can arc across substantial air gaps. Operators should seek advice from the regional electricity board on this matter.

15 The owner of the land and the electricity board should also be consulted as to the presence of underground electrical cables, where it is necessary for equipment to be staked into the ground.

ASSEMBLY AND DISMANTLING OPERATIONS (PARAGRAPHS 134 - 155 OF THE CODE)

16 All assembly and dismantling operations should be directly supervised by a person trained and experienced in such work. A safe system of work should be followed. All parts should be checked for excessive wear, damage, or deformation during assembly and dismantling.

17 The central vertical column and base support should be carefully located on firm and even ground, and adequately supported by suitable packing to prevent any movement. All outriggers should be used and properly supported. No further assembly should

start until the supervisor is satisfied that this assembly is level, stable and secure.

18 Packing should be positioned in accordance with any manufacturer's instructions, and should be made from solid timber or other suitable materials. It should be capable of withstanding the compression loads involved, and the stresses set up by the ride in motion. It should have a base area which gives adequate load-spreading support for the ground conditions on any particular site.

19 It is of particular importance that the structure should be assembled in the correct sequence and in accordance with manufacturer's instructions, where published.

20 All assembly pins or bolts should be kept in position by appropriate securing devices. Where a manufacturer supplies a particular type of securing device, pins of the original manufacturer's design or its equivalent specification should be used.

21 When assembly is complete, the operator should check the device to see that it has been properly and safely assembled. He should then run the ride with the chairs empty, and check its safe operation including all controls. After this trial run, the operator should check the assembly again, paying particular attention to the stability of the base structure and packing to ensure that there has been no movement or settlement.

22 The Chair-O-Plane should not be used to carry passengers until the operator is sure that the ride has been safely assembled.

SAFE ACCOMMODATION OF PASSENGERS (PARAGRAPHS 31 - 40 OF THE CODE)

23 Since the ride generates varying centrifugal forces, it is particularly important that every individual passenger is adequately secured into his seat, to ensure that he cannot inadvertently fall or be thrown from it during the ride. Each seat should be provided with adequate back, side and front support to prevent falls.

24 From past accident experience a simple loose chain restraint, secured by a spring loaded clip, has not prevented passengers from slipping forward between the chain and the seat. Where practicable, this should be supplemented by a suitable passenger restraint, such as a fixed restraint at the front of the seat, which prevents the seated passenger moving forward in this way. The restraint arrangement should extend from one side of the seat to the other. It should be arranged to allow access to and egress from the seat, and then be closed up again after the passenger has entered the seat.

25 A simple spring-loaded clip is also unsuitable because failure of the spring in the clip allows the restraint to open. An improved clip, which does not fail in this way, and which is less easy to open inadvertently, should be substituted.

26 Each restraint arrangement should be provided with adequate locking devices, which are fully closed and checked by the ride attendant or operator before the ride is set in motion. The ride should be brought to a complete halt before passengers dismount. The locking device should consist of a positive catch arrangement, and be positioned so that it cannot be inadvertently opened by passengers in the chair. All locking devices should be regularly inspected to ensure they do not fail in operation. Arrangements should also be such that locking devices do not fail in a way which creates danger (e.g. opening on the failure of a spring).

27 The ride should not start until the enclosure within the perimeter fence is clear of all persons, except for passengers who are properly seated and protected by the passenger restraint. No person should enter this enclosure while the ride is in motion.

28 Passengers should remain correctly seated throughout the ride. This rule should be reinforced by verbal warnings (e.g. from an amplified loud speaker, and by legible notices). All reasonably practicable steps should be taken to prevent loose items from being taken onto the ride.

ACCESS TO THE RIDE (PARAGRAPHS 57 AND 58 OF THE CODE)

29 The ride should be provided with a perimeter fence. The fence should be at least one metre high,

and should be capable of withstanding people leaning on it, or being pushed against it. In order to prevent anyone being struck by the seats or by passengers' legs, the fencing should be designed and positioned so there is at least 2.5m vertical distance from the ground on the outside of the fence to the chairs or any other moving part (see diagram). The number of passenger openings for access and egress, and their width, should be limited as necessary for safe loading and unloading. Exceptionally, 5 openings in a small diameter 10 section ride may be allowed, where the ride is accessible from all directions and where supervision is adequate.

30 At a ground-based ride, a ramp-access ride, or a platform-based ride where the platform is 300mm high or less, the necessary openings should be protected by additional physical means (e.g. turnstiles, swing-gates, or off-set barrier and step arrangements) to prevent people from entering the danger area. In addition, there should be effective supervision to prevent access to the danger area.

31 At a platform-based ride where the platform is more than 300mm high above ground level, the necessary openings should be safeguarded either (a) as outlined in paragraph 30, or (b) by at least one step 150mm or more high with at least 1.1m between the outside edge of the bottom step and the nearest part of the path of the moving parts of the device. In addition, there should be effective supervision at each opening to ensure that there is no access to the platform or steps while the ride is in motion.

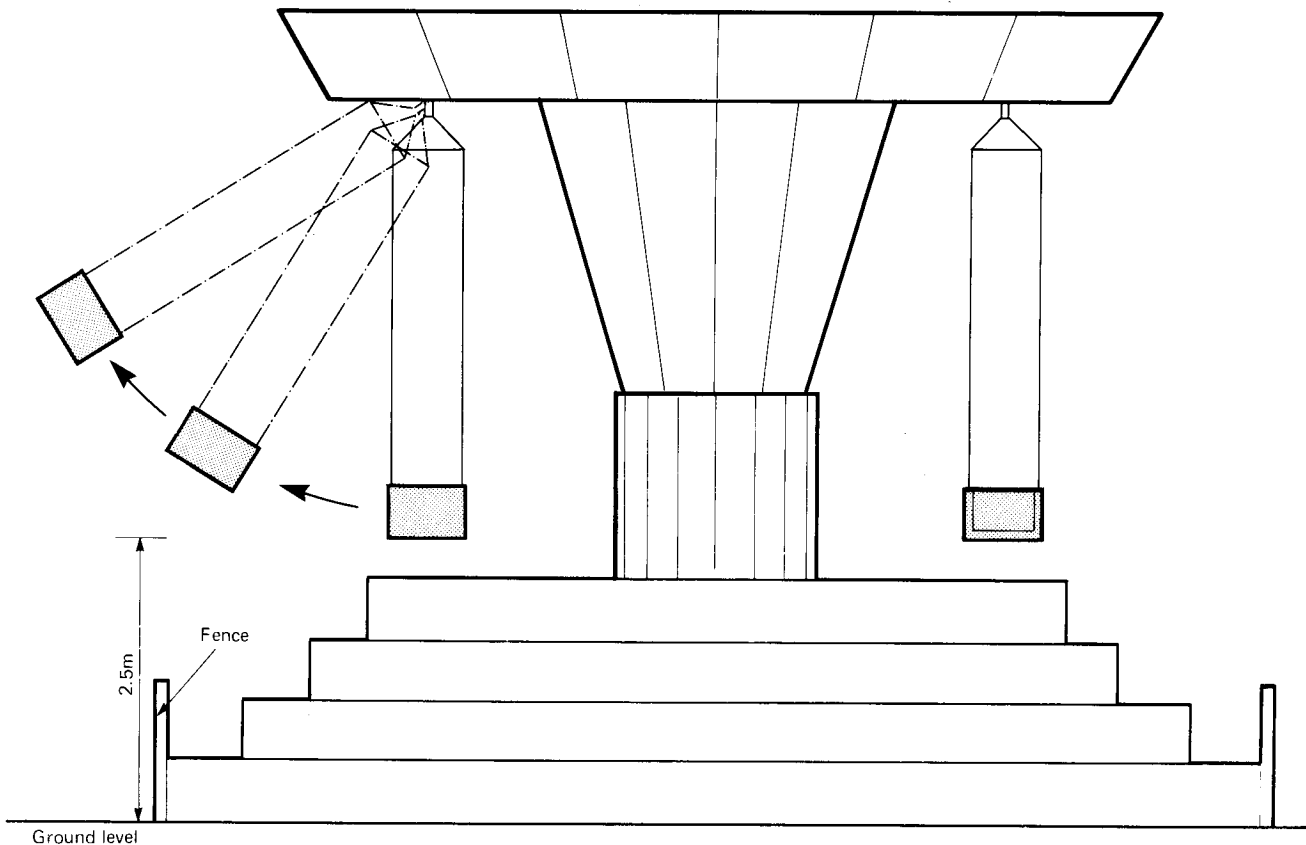


Diagram 1. Diagram of a 'Chair-o-plane' ride illustrating minimum safe vertical distance at perimeter fence

SAFE OPERATION (PARAGRAPHS 41 - 70 OF THE CODE)

32 The operator should determine the minimum number of attendants needed to operate the ride safely, and ensure that at least this number is on duty when the ride is in operation. There should be sufficient attendants to control entry of the public into and out of the enclosure. The operator should man the controls throughout the time the ride is in motion. The ride should be isolated from the power source when it is closed to the public.

33 The system of work should ensure that the public are admitted into the enclosure only when the ride has been brought to a halt. Passengers should not be allowed to move forward onto seats until it is safe to do so.

34 During loading, the operator should ensure that the weight of passengers is evenly distributed and balanced around the ride, so far as is reasonably practicable.

35 When the ride is started, the speed should always be allowed to build up gradually, so as to ensure a smooth ride. The maximum operational speed specified in the log book should not be exceeded. The ride should be slowed down carefully to a halt. Any sudden stop by application of a brake is dangerous.

TRAINING OF OPERATORS AND RIDE ATTENDANTS (PARAGRAPHS 71 AND 72 OF THE CODE)

36 Each operator should receive full and sufficient training in the working of the Chair-O-Plane. This should include adequate instruction on:

- (a) the method of operating the ride;
- (b) safe loading of the ride;
- (c) maximum operational speed;
- (d) systems of work necessary to ensure the safety of attendants;
- (e) the system of work necessary to ensure the safety of passengers and members of the public;
- (f) training needs of attendants;
- (g) safe methods of assembling/dismantling;
- (h) how to make a daily inspection of the ride. Where available, advice from the manufacturers of the ride should be incorporated into this instruction.

37 It is also desirable that operators are aware of the Code requirements relating to the intervals at which thorough examination and testing should be carried out, and the reasoning behind such procedures.

38 Each attendant should receive suitable and sufficient training for the type of work he is expected to do. Training should include adequate instruction on:

- (a) arrangements for controlling the public to and from the enclosure;
- (b) arrangements for the safe accommodation of passengers;
- (c) risks and precautions associated with the work;
- (d) procedures for reporting defects or breakdowns;
- (e) measures which should be taken in the event of an emergency.

39 Ride attendants should remain in safe positions while the ride is in motion. They must not ride other than in the properly seated position, and should not indulge in any reckless behaviour. Particular care is needed when fares are being collected.

EXAMINATION, INSPECTION AND MAINTENANCE (PARAGRAPHS 1 - 30 OF THE CODE)

Examination (Paragraphs 8 - 19 of the Code)

40 Each Chair-O-Plane should be thoroughly examined at least once in every 14 months by an appointed person as required by the Code. In the case of rides used on a seasonal basis, this should be carried out where practicable before the commencement of each season, but, in any case, within 3 months of its commencement.

41 The thorough examination should include the following:

- (a) the packing and condition of the central hub and main vertical column;
- (b) the condition of the radial arms, the tie bars, stays, and spacers, together with their support and connecting arrangements;
- (c) the passenger seats and their support chains, rods, or wire ropes, and the suspension arrangements between chains and radial arms;
- (d) the running gear and the drive mechanism;
- (e) the perimeter fence and pay box;
- (f) the seat restraint arrangements, including all locking devices to each chair;
- (g) the general condition of each seat;
- (h) the hydraulic systems to the ride;
- (i) the electrical systems to the ride, including any interlocking systems;
- (j) the braking systems, where fitted;
- (k) the ride platform and steps, together with their support structure.

The above list is not exhaustive, and the examination should include all the parts which may affect the safe operation of the ride.

42 The appointed person should also arrange for appropriate non-destructive testing methods on key

components to test for cracks which could indicate the onset of failure due to fatigue or other causes. It is particularly important for these methods to be used on the centre vertical column, main welded joints and seat support arrangements.

43 The appointed person should be aware of any fatigue life appraisal carried out by the manufacturer in his design calculations for the ride. Where the manufacturer advises a replacement life for a part, the appointed person should satisfy himself that this has been met.

44 Paint on the structure of the Chair-O-Plane may cover cracks and defects. It is important that the appointed person bears this in mind when conducting visual examinations. Paint should be removed from areas that may be subject to high stress or susceptible to cracks or other faults.

Inspection (Paragraphs 20 - 30 of the Code)

45 The daily inspection should be carried out before first use on any day. Where available, advice provided by the manufacturer should be taken into account.

46 The inspection should include checks of:

- (a) the car restraint arrangements, to ensure that they are functioning properly without defect;
- (b) the seats and their support chains, rods, or wire ropes;
- (c) the bearing assemblies connecting the radial arms to the central hub;
- (d) the packing and stability of the central column and hub;
- (e) the tie bars and spacers.

Once the daily inspection has been completed, the ride should be given a trial run before it is used to carry passengers. It should not be made available to the public until any adjustments or repairs, judged to be necessary as a result of the inspection, have been satisfactorily carried out.

Maintenance (Paragraphs 24 - 30 of the Code)

47 The Chair-O-Plane should be properly maintained. Where manufacturer's guidance and schedules are available, these should be taken into account. Where schedules are not available, the owner should specify the procedures in the light of experience and any advice received.

RECORDS

48 Records of all examinations, as required by paragraph 3 of the Code, and records of daily inspections, should be kept at the ride, or be readily available.

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