Guidance Note PM 72 from the Health and Safety Executive

Safe operation of passenger carrying amusement devices - trabant

Plant and Machinery Series PM 72 (January 1990)

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

INTRODUCTION

1 The *Code of safe practice at fairs* was published by the Health and Safety Executive (HSE) in April 1984. It is the result of a joint initiative between HSE and the associations* representing the amusement industry designed 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 the Trabant ride and precautions that should be taken to avoid them. It is intended for operators, ride attendants and anyone concerned with the safe operation of this type of ride.

3 The guidance is based on HSE reports of 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 and its Technical Annex. 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 Guidance Note relates to the passenger carrying amusement device known as the 'Trabant' and to design variations such as the Satellite, Galaxy, Mexican Hat and Hully Gully. Some of these names may be used for other rides of a different type. Conversely, other names may be used for this type of ride.

DESCRIPTION OF RIDE

5 There are a number of designs of Trabant each different in detail but with a common motion and construction.

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

6 The ride consists of a main substantial base structure with folding outrigger supports which is usually constructed as a trailer. Onto this special structure and permanently connected to it is a revolving frame referred to as the turret. Mounted on this is a boom assembly, hinged at one end of the turret and capable of being elevated by a hydraulic ram, on which is placed the central hub. Onto this is mounted the radial arms assembly (RAA) which carries 20 passenger cars around the circumference. The platform is built off the main base structure in sections to provide an access platform. Some models have a retractable platform to facilitate easier transportation from site to site. See Figures 1 and 2.

7 The motion of the ride is created by rotating the turret in a clockwise direction and rotating the RAA in an anti-clockwise direction. When lifted the RAA creates an undulating effect. The physical effect on the passenger is that of driving over a hump back bridge at speed. On some models the ride cycle can be reversed. The RAA and turret should not be operated in the same direction.

8 The drive assembly usually consists of a hydraulic system. The central turret is rotated by a hydrostatic motor coupled to a gear box and slew ring. The RAA is rotated by two hydrostatic motors directly coupled to two small inflated pneumatic tyres which drive the outer rim. Earlier models of this ride had electric motors with magnetic brakes to achieve turret rotation and RAA rotation.

9 Most Trabant rides have flat loading platforms circular in design reached by steps. There are a number with an angled loading platform which is low at the front of the ride with access from ground level.

RISKS

10 The safe design and safe operation of the Trabant should guard against:

(a) passengers being thrown from the car;
(b) a car breaking away from the radial arms assembly;
(c) failure of the car mounting frames;
(d) failure of passenger restraint arrangements;
(e) failure of the central drive unit;
(f) failure of the hydraulic lifting assemblies;
(g) injury to passengers mounting/dismounting from the cars;
(h) injury to passengers, spectators and other people in the vicinity of the ride while it is in operation.

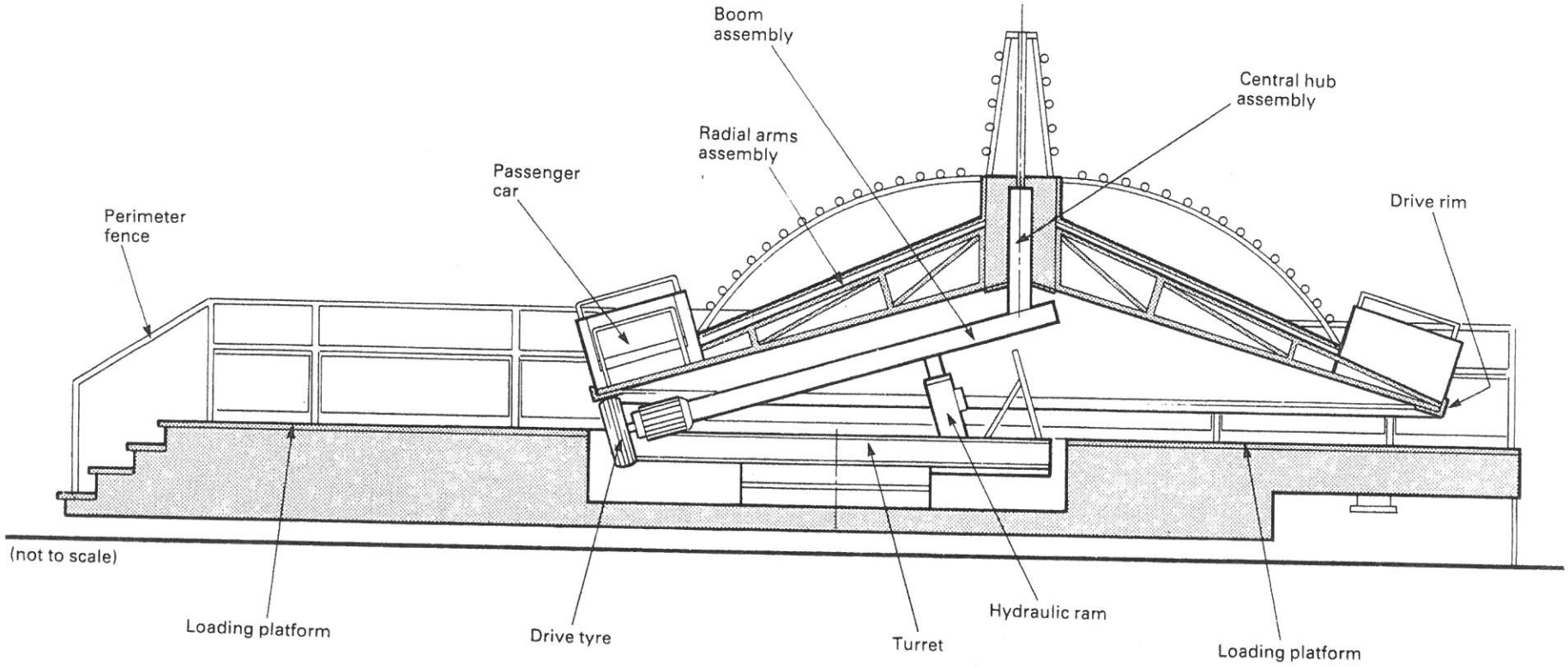

Fig. 1 Cross section of trabant in lowered position

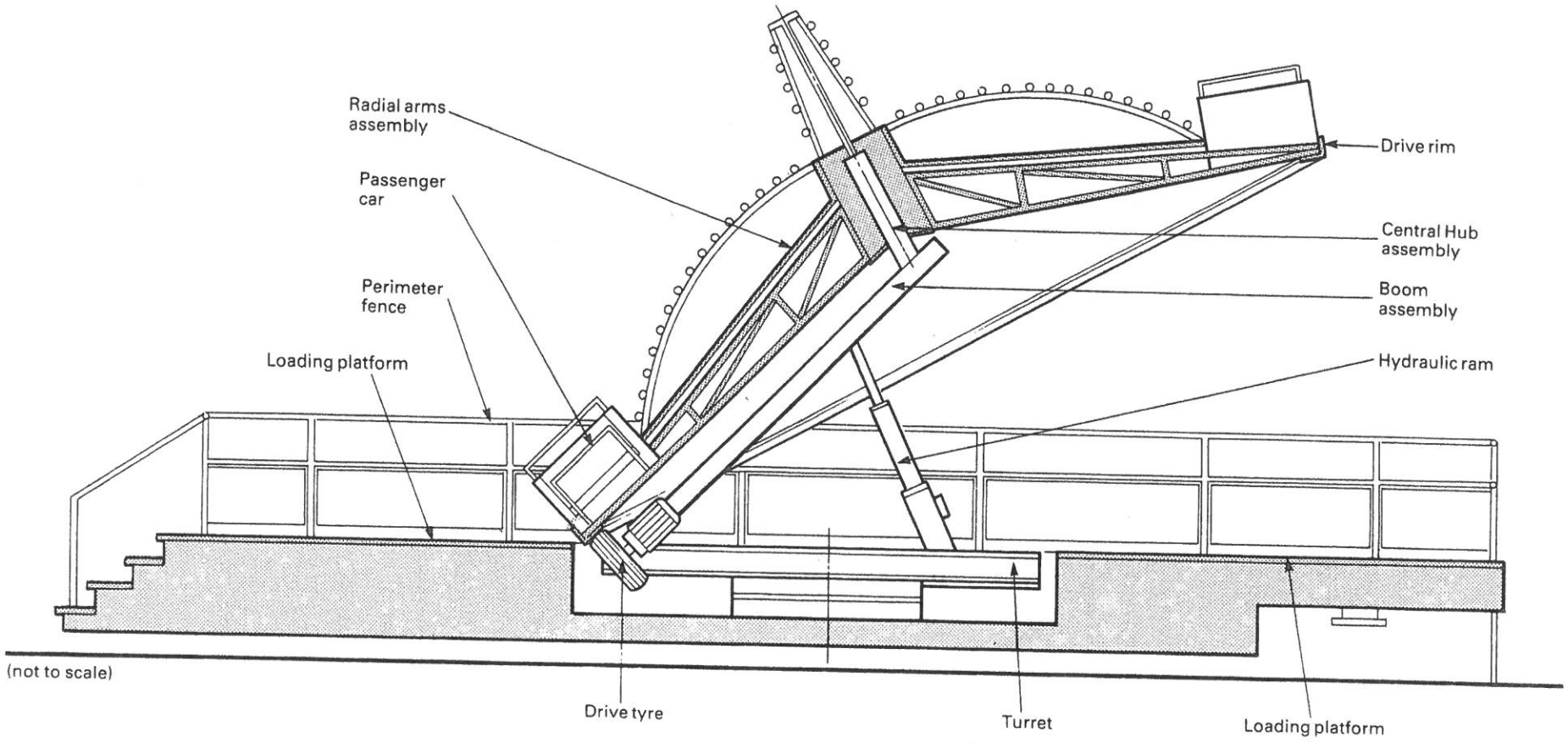

Fig. 2 Cross section of trabant in the elevated position

DESIGN, MANUFACTURE AND MODIFICATION
(Paragraphs 4 to 163 of the Technical Annex to the Code)

11 The drive arrangement to the ride should be incapable of exceeding the specified maximum operating speed which should be clearly marked at the ride controls.

12 The ride should be constructed or modified only after full determination of the likely stress levels and fatigue expectations of the ride. This is particularly important in relation to quality of material used in the ride's construction and the quality and type of welding used.

13 The ride should be designed so that the hydraulic systems work within their capability and do not put valves and connections under undue stress. Hydraulic equipment manufacturers should be consulted as to the compatibility of these systems with the design of the ride.

14 Limit switches should be fitted to the lifting system to prevent the ram from topping on the cap of the ram barrel.

15 All connecting pins which are intended to join the structure together should be to a specification laid down by the designer including material specification, configuration and manufacturing quality or equivalent specification.

16 The design of the hydraulic system should provide connecting points so that pressure and flow of the hydraulic oil can be checked without having to disturb any of the fixtures and fittings.

SITING AND LOCATION
(Paragraphs 110 to 133 of the Code)

17 The Trabant 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 overhead power lines is always a sufficient precautionary measure, since electricity at high voltage can arc across substantial air gaps. Operators should seek advice from the local electricity board on this matter.

ASSEMBLY AND DISMANTLING OPERATIONS
(Paragraphs 134 to 155 of the Code)

18 The Trabant trailer-mounted base should be located on firm ground and supported on 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 stable and secure. The ride should be level except where the design specifies otherwise.

19 Packing should be positioned in accordance with the manufacturer's instructions where these are available and should be made from solid timber or other suitable materials. It should be capable of withstanding the compression loads involved and the stresses and vibrations set up by the ride motion.

20 It is important that the ride is assembled in the correct sequence and in accordance with manufacturer's instructions, where published.

21 All assembly and dismantling operations should be directly supervised by a person trained in such work. All parts and packing materials should be checked for excessive wear, damage or deformation.

22 Once the ride has been erected the operator should check the device to see that it has been correctly assembled and that no parts have been omitted. The ride should then be run with the cars empty and all controls and brakes should be checked for safe operation.

SAFE ACCOMMODATION OF PASSENGERS
(Paragraphs 31 to 40 of the Code)

23 The passenger restraint consists of a fixed hinged gate, which prevents the seated passenger moving forward off the seat. The gate pivots away from the passengers to allow people to get in and out of the cars. Since the ride generates varying centrifugal forces it is important that passengers should be adequately secured in the car, to ensure that they cannot fall or be ejected from it during the ride.

24 Each seat restraint arrangement should have a suitable locking device with a positive catch arrangement, constructed and positioned so that it cannot readily be opened by passengers in the car. All locking devices should be regularly inspected to ensure that they do not fail in operation.

25 The locking arrangement on each car should be checked by an attendant before the ride is set in motion. The ride cycle should not be set in motion until the area within the perimeter fence is clear of everyone except the passengers who are properly seated and restrained in the cars. A designated area must be provided for ride attendants who are not directly supervising entrances.

26 To ensure the safe accommodation of passengers it is important that the outside passengers are of sufficient height for their feet to reach the footwell. These requirements should be reinforced by notices and verbal instructions and should be strictly enforced. All reasonably practicable steps should be taken to prevent loose items from being taken onto the ride.

ACCESS TO THE RIDE

27 The ride should have a perimeter fence at least one metre high, and capable of restraining anyone leaning on it, or being pushed against it.

28 The number of passenger openings in the fence for access and egress should be limited to the number and width necessary for safe loading and unloading. No more than four such openings should be allowed.

29 At a ground-based ride, a platform-based ride with a platform of 300 mm in height or less, or a ramp access ride, physical means such as turnstiles, or off- set barriers should be provided at necessary openings to prevent people entering the danger area. The danger area should be clearly defined and effectively supervised.

30 At a platform-based ride where the platform is more than 300 mm high the access openings should be safeguarded either:

(a) as outlined in paragraph 29; or

(b) by one step at least 150 mm high with at least 1.1 m between the outside edge of the bottom step and the nearest part of the moving parts of the device together with effective supervision of each opening to ensure that there is no access to the platform while the ride is in motion.

SAFE OPERATION OF RIDE
(Paragraphs 41 to 70 of the Code)

31 A safe system of work should be instituted by operators and instructions given to attendants on the proper method of securing passengers on the ride. (See also paragraphs 23 and 25).

32 The operator should decide how many attendants are needed to operate the device safely and should ensure that these are on duty when the ride is in operation.

33 The operator should ensure that passenger loading is evenly distributed and balanced round the ride. (Reference should be made to advice given by manufacturers).

34 The ride should be stopped immediately if any passenger is observed tampering with any restraining device, behaving dangerously or in a reckless manner. The operator and attendants should ensure that loose articles are not taken onto the ride (see paragraph 26).

35 No person other than a trained operator should be in charge of the device. The operator should remain at the controls throughout the ride cycle.

TRAINING OF OPERATORS AND ATTENDANTS
(Paragraphs 71 to 72 of the Code)

36 Each operator should receive suitable and sufficient training in the safe operation of the Trabant. This should include adequate knowledge of:

(a) the method of operating the ride;
(b) safe loading of the ride;
(c) maximum operating speeds;
(d) the system 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) the correct method of assembly/dismantling the ride (where necessary);
(g) the method of daily inspection and keeping of records.

37 Attendants should receive suitable and sufficient training for their type of work. This should include:

(a) arrangements for ensuring the safe loading/unloading of passengers;

(b) the risks and precautions associated with their work;

(c) ensuring passengers secure all articles which may become loose while riding;

(d) the procedures for reporting defects;

(e) the measures which they are required to take in the event of an emergency.

38 Ride attendants:

(a) ride attendants must stay in a place of safety while the ride is in motion;

(b) ride attendants must not ride on parts of the Trabant in motion other than in the properly seated position.

Particular care is needed when fares are being collected.

ACCESS BENEATH THE BOOM ASSEMBLY

39 When work or inspection is to be undertaken beneath the raised boom assembly, suitable props should be provided.

EXAMINATION
(Paragraphs 1 to 19 of the Code)

40 Each ride should be thoroughly examined at least once every 14 months by a person appointed under the Code. Trabant rides used on a seasonal basis should be examined where practicable before the start of each season, but in any case within three months of its starting.

41 The thorough examination should include the following:

(a) the packing points and outriggers;

(b) the condition of the central base;

(c) the base structure;

(d) the hub support shaft and housing;

(e) the radial arms assembly;

(f) the turret assembly;

(g) the boom assembly;

(h) the hydraulic ram, mountings and fittings;

(i) the limit switches and fittings;

(j) the condition of hydraulic hoses, pipes and fittings;

(k) the condition of the car frames and retaining plates and bolts;

(l) the drive tyres and drive assemblies;

(m) the electrical systems;

(n) the control systems.

The above list is not intended to be exhaustive. The examination should include all parts which may affect the safety of the ride.

42 The appointed person should consider appropriate non-destructive testing (NDT) methods on key components. Reference should be made to the Technical Annex on this subject. On this ride the following parts should be considered:

(a) the hub support shaft and housing;

(b) the radial arms to test for corrosion;

(c) the boom assembly;

(d) the turret assembly;

(e) the base structure;

(f) the car frame to test for corrosion/thickness;

(g) all welds on box sections.

INSPECTION OF THE RIDE
(Paragraphs 20 to 23 of the Code)

43 The inspection before use each day should take account of:

(a) the packing and stability of the base structure and outriggers;

(b) the mounting points where the radial arms are connected to the central hub;

(c) the cars and restraint arrangements;

(d) the car fixing plates;

(e) pins and retaining clips;

(f) the tyres, brake systems, drive systems, hydraulic hoses and hydraulic oil level.

This should be done in conjunction with the manufacturer's manual.

44 The ride 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 carried out.

45 Immediately prior to any ride being taken into use on any day, a trial run should be carried out.

46 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.

MODIFICATION
(Paragraphs 107 to 109 of the Code)

47 No modification that may affect the integrity of the ride should be made unless the design concept and its implementation have been established as sound with the manufacturer or an independent consulting engineer. A further thorough examination should be completed before the Trabant is used again.

FURTHER INFORMATION

This Guidance Note is produced by the Health and Safety Executive. Further advice on this or any other publication produced by the Health and Safety Executive is obtainable from St Hugh's House, Stanley Precinct, Bootle, Merseyside L20 3QY, or from Area Offices of HSE.

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