

## Standards & Related Documents Committee

### TECHNICAL BULLETIN - OCTOBER 1999

#### 197. Pinfari Dragon Roller Coaster Accident

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We have received a report, from NAFLIC member John H Rundle Ltd, of some of the details of the fatal accident which occurred this summer at Folkestone involving a Pinfari Dragon roller coaster. This occurred when, despite the lap bar restraint, a 8½ year old girl managed to get into a position from which she was either ejected from, or fell out of, the rear car.

The precise details of the cause of the accident will not be available while the investigation remains incomplete. We therefore discuss some of the hazards / risks which may or may not be present on such multiple-circuit roller coaster rides (i.e. ones which may execute more than one circuit, passing through the station without stopping) :-

1. Loading / unloading platforms normally have barriers at either end to protect intending passengers from falling. Such end barriers may become shear hazards (affecting extended arms or even heads), negotiated at high speed when the train passes through on a non-stop circuit. In such circumstances it is sometimes necessary to eliminate the shear trap, dependent on the risk assessment.
2. Bearing in mind the speed at which trains may pass through the station platform, it may, in some circumstances, be necessary to take steps to reduce the risk to intending passengers by limiting access, etc.
3. When only one person is seated in a double seat protected by a single restraint, he may, in some designs, be able to swing his legs round to escape the confines of the restraint.
4. When two persons in a double seat are contained by a single restraint, it may be necessary to consider whether the smaller passenger is adequately protected.
5. Sometimes restraints may be sloppy (because of wear or by design). In the case of ratchet locking, even if the pawl spacing is small, there may be significant play at the bar if there is a large mechanical advantage. Small amounts of wear will then also translate into much larger play.
6. In roller coaster design, track banking is used to constrain the magnitude of transverse accelerations experienced by the passengers. On curves near the station the banking angles are a compromise, because they have to deal with high speed and low speed laps.

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There may in some cases, therefore, be a significant transverse acceleration or jerk. If there is doubt that the passenger would be able to anticipate this, and there would be a risk of ejection if the passenger were not properly seated, the need for positive restraint equipment is clear.

7. If there is doubt that the passenger would be able to anticipate significant transverse accelerations or jerks and there is a significant risk that may be difficult to perceive, particularly for mentally immature passengers, it may be necessary to consider whether age / height limits are high enough.