Risk assessment of sharp edges in trains

Suganth Rajendra Kumar

Bombardier Transportation UK

ABSTRACT

There is no clear definition in the UK rail industry for a sharp edge when it comes to non-rigid metallic edges such as sheet metal edges. In Bombardier Transportation UK, this was managed by a joint safety and human factors assessment to determine the level of risk posed by such edges to train users. An on-train subjective risk assessment was done based on three parameters; access, worst case scenarios and sharpness. This case study highlights the limitations of this approach by comparing it with an existing standard; the children's product safety specification 'Sharp Points and Sharp Edges' (Code of Federal Regulations, 2018). Lessons have been learned from this comparison, which will feed into future process improvement.

KEYWORDS

Exposed edge, Sharpness, Skin pressure sensitivity

Introduction.

In Bombardier Transportation (BT) UK, there is an internal requirement to mitigate the risk of sharp edges in the design of train equipment or structures. According to the requirement, the design shall not present any exposed sharp edges that could present unacceptable risks to the train user upon contact and all exposed edges should have a radius of greater than 5mm. Train interior design engineers found that this requirement could not be applied to thin sheet metal edges as a radius of greater than 5mm makes them sharper. Concern was raised with regard to an edge in the passenger area of one train carriage. The BT human factors (HF) and safety teams were consulted by the interior design engineers with an objective to determine the level of risk posed by this exposed edge to the train user. As a member of the safety team with HF experience, I conducted an on-train subjective risk assessment of this edge to determine whether it could be classified as a sharp edge. Subsequently, I compared this method with the test method prescribed in the children's product safety specification standard 'Sharp Points and Sharp Edges' (Code of Federal Regulations, 2018) to understand the limitations of the on-train subjective risk assessment.

Investigation & analysis

The objective of the risk assessment is to determine whether the level of risk posed by this edge to the train user is sufficient to classify it as a sharp edge. In the absence of any specific UK railway industry standard or internal requirement, an on-train subjective risk assessment of the edge was conducted. The on-train risk assessment was done based on three parameters namely; access, worst case scenarios and sharpness.

Firstly, the access to the edge was analysed based on its location in relation to the passenger area. The edge is located at 25 mm from the floor level and flush with the adjacent trim panel. Thus, it is close to the floor and does not protrude into the passenger area. Therefore, it was concluded that the edge is difficult to access for the passengers.

Secondly, worst-case scenarios were defined, as those in which the worst-case user comes into contact with the edge. In the context of the access to the edge and considering skin pressure sensitivity (Myles and Binseel, 2007), the worst-case scenario is that of a female child adopting a bent or crawling posture and running her finger over the edge either deliberately or by accident.

Thirdly, the sharpness of the edge was evaluated with an objective to determine whether it is sharp enough to cause slight discomfort. At first, an inspection of the edge was performed by the quality engineer to ensure that the edge is safe to be touched. Subsequently, the assessors (myself and the interior design engineer) ran our fingers over the edge adopting the posture described in the worst-case scenario, with increasing force until we were satisfied that the edge would not cause slight discomfort. It must be noted that the worst-case user is a female child whereas both the assessors are adult males who have a higher skin pressure sensitivity threshold than the worst-case user (Myles and Binseel, 2007).

Resolution of the problem

It was found in the investigation and subsequent analysis that the edge is difficult to access. Also, the probability of the worst-case scenario happening in real life is considered to be low. Most importantly, the edge was found not to cause slight discomfort to the assessors and consequently unlikely to cause slight discomfort to the worst-case user. Therefore, it was concluded that the edge is not a sharp edge and the risk posed by the edge is acceptable.

Impact & implications

The children's product safety specification standard 'Sharp Points and Sharp Edges' (Code of Federal Regulations, 2018) provides technical requirements and a test method for determining sharp metal edges in toys and other articles intended for use by children in an everyday use setting. This standard is applicable to the sharp edge under consideration as it includes thin sheet metal edges and the worst-case user is a female child. When this was compared with the on-train subjective risk assessment method, the following key limitations were found:

- The standard prescribes the use of a sharp edge tester instead of using the assessor's fingers to interact with the edge. This removes the inherent health and safety risk that the assessor's fingers could be injured during the test.
- The standard details a test method and procedure which provides a consistent way of using the sharp edge tester in different settings. Moreover, the sharp edge tester provides an objective result, thus minimising the impact of subjective biases such as individual differences in skin pressure sensitivity as observed with the on-train subjective risk assessment.

Based on these findings, it is recommended to adopt the test method in the children's product safety specification standard for identifying thin sheet metal sharp edges in the train interior. This is being reviewed by the BT HF team and will feed into future process improvement.

References

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