The Passenger Input to Escalator Accidents

David Cooper

LECS (UK) Ltd & University of Northampton

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Abstract. The number of accidents occurring on escalators and moving walks around the world is increasing. This paper looks at some typical and non-typical accidents and will investigate the passenger input into the event. It is known that many accidents occur as a result of intended misuse and/or miscreant behavior however it has been found that some accidents occur as a result of totally innocent input by the passenger. To some in the industry the action of the passenger is obviously dangerous and leads to the event but some accidents are as a result of chance and often bad luck.

1.0 INPUTS INTO ESCALATOR ACCIDENTS

Dr Lutfi Al Sharif, in his paper entitled "Escalator Human Factors: Passenger behavior, accidents & design" [1] created a Venn diagram identifying the three inputs to escalator passenger accidents. These were:

- Design
- Maintenance, Inspection & Operation
- Passenger Behavior

The Venn diagram can be seen below (Fig 1) with the section entitled "Passenger Behaviour" highlighted in yellow.

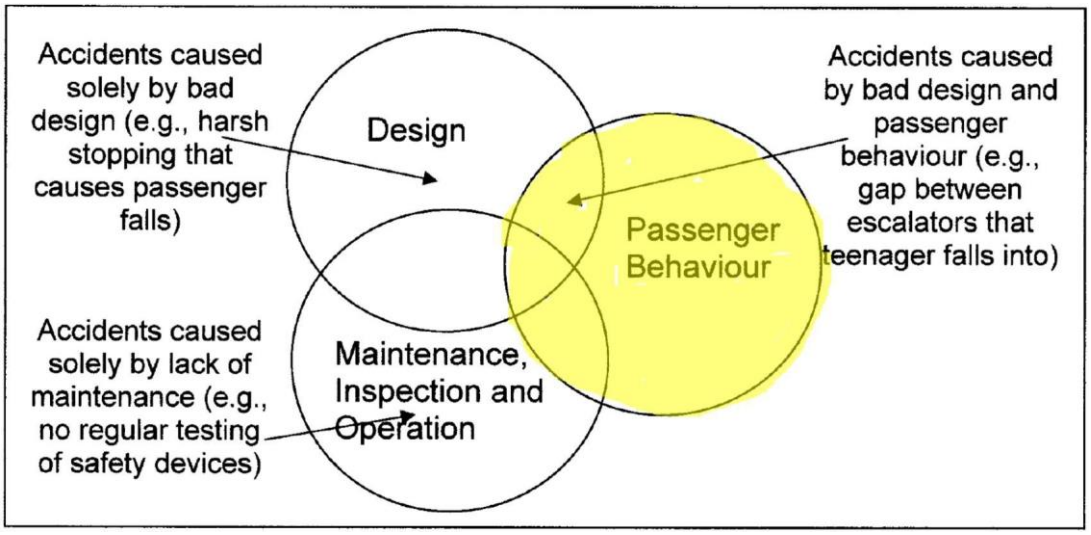


Fig 1: Al Sharif Venn Diagram [1]

The number of escalator accidents involving personal injury occurring are rising and litigation following accidents is similarly increasing. The works of Gerk [1], Cooper [2], White [3] and Owen [4] indicate this is the case.

When litigation occurs the contribution of all three elements of the Venn diagram will be taken into consideration and escalator owners (the defendants) will want to promote the actions of the passenger as primary causation whereas the claimant (generally the injured party) will want to

point towards defects in design and/or maintenance, inspection & operation.

Whilst accidents occur that involve a single element of the Venn diagram very often there will be two or three of the elements involved.

2.0 PASSENGER BEHAVIOR

The purpose of this paper is to identify examples of passenger behaviors that contribute to escalator accidents.

In cases where passenger actions have been either causative or contributory to the accident they can generally be categorized as

1.1.1 Intended Misuse
1.1.2 Unintended Misuse

This categorization is troublesome as some may argue that a person getting on an escalator with luggage or using a walking stick would not be aware of the potential risk of a runaway suitcase causing a cascade fall or a walking stick tip under load being across the joint between two steps when they go into transition.

The troublesome element is when a passenger repeats the same unintentional error and a similar accident occurs where a further risk category can be introduced of willful negligence.

Owners very often rely on CCTV footage when defending legal actions and this can be extremely helpful in any analysis post incident. The following photographs refer

Photo 1: Wheelchair user about to board an escalator

Photo 2: Miscreant youths riding the handrail

Photo 3: Child riding handrail

Photo 4: Youth holding onto handrail external to the step band

Photo 5: Youth sliding down the centre deck

Photo 6: Person struggling with a luggage cart

The passenger input into these events is obvious yet it may be argued that in photo 4 the child was of an age so as not to be aware of the danger he was putting himself in.

Similarly, the lady in photo 7 may well be oblivious to the risk she is placing herself (and indeed others below her on the escalator) in.

The one thing for sure is that once the people in the photographs have had an accident, they are unlikely to repeat their actions.

Some accidents involving passengers can be defined as being completely innocent with no deliberate input into causation but nevertheless an accident occurs.

These include footwear entrapment where the passenger has no idea that the wearing of such items can end in a serious accident.

It is true to say that there is a secondary component to the accident over and above the innocent wearing of footwear in as much as their feet must have been in a position of danger for the accident to occur.

There are a very few numbers of escalator owners who mark where a passenger should stand on an escalator step so how would a passenger know? You aren't taught at school where to stand! That having been said there are many asset owners who have or are still trying to improve the situation. The HSE PM34 document "Safety in the use of escalators" [6] was intended to educate passengers and its replacement SAFed EMW [9] features all aspects of escalator safety.

Photo 7: Footwear entrapment

Photo 8: Footwear entrapment

Other accidents where the innocent action of a passenger result in injury. In the incident below the young girl bent over to pick up a coin she had dropped and her hair went between steps and became entangled. Amore common occurrence is shoe lace entrapment.

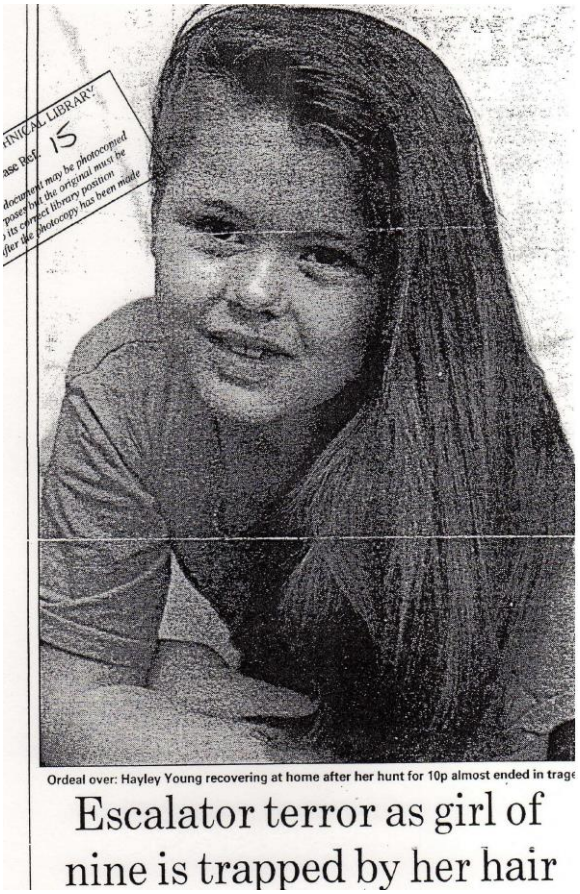


Fig 2: Hair Entrapment

3.0 ACCIDENT PREVENTION

A way of preventing accidents is education and/or signage however even such an approach can be criticized as it could be construed that you are actually educating a person to misbehave and if they are of an adventurous character it may promote miscreant behavior.

Similarly, signage can be criticized as being an invitation to misbehave and where do you stop when it comes to pointing out potential hazards? Signage is very often ignored by a passenger and is often used in a legal argument to simply say “we pointed out the risk in advance”.

EN115-1 (2017) Annex G [7] introduces some standard signage that should be posted which is limited to 4 signs:

G1 Small children should be held firmly

G2 Dogs shall be carried

G3 Use the handrail

G4 Pushchairs not permitted

Figure G.4 — Prohibition sign "Push chairs not permitted"

Fig 3: Sign from annex G of EN115-1 (2017) [7]

This is very limiting and does not cover many of the passenger contribution to accidents.

In addition, owners of escalators have for many years introduced their own signage for risks post incident:

Photo 9: Bespoke Signage

4.0 MITIGATION

As the number of litigation cases increases escalator owners need to be aware of the need to maintain documentary evidence of risk assessments, proper design, appropriate specification and sound maintenance.

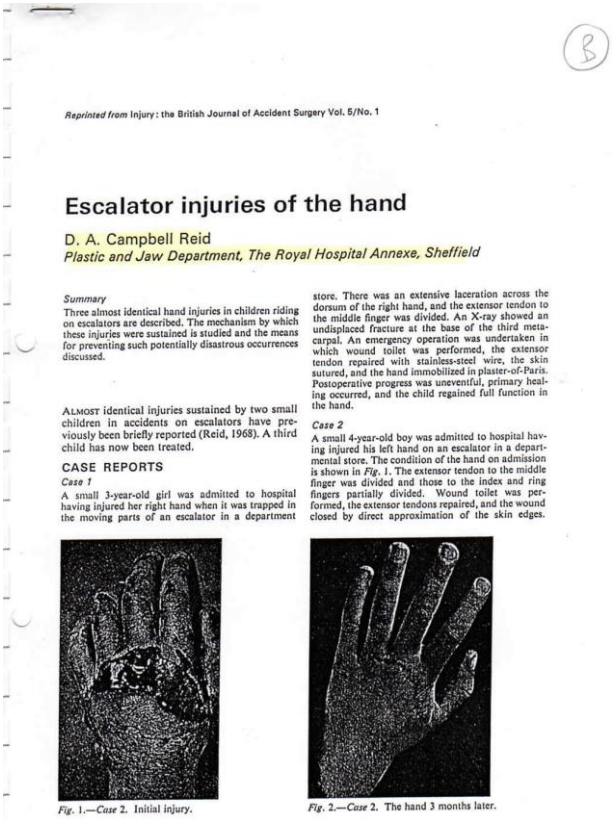
In many cases the only argument is that it was the actions of the injured party (or someone else on the escalator that caused the injury) as a form of defence. This may be a sole contributory factor or a combination of factors such as those detailed in the Al-Sharif Venn diagram in Fig 1.

When it comes to mitigation for an escalator owner in situations where obvious misuse isn't involved there are a number of issues that very often get introduced but require supporting evidence, these include:

- Condition of footwear
- Alcohol Intoxication
- Drugs
- Luggage
- Rushing
- Using a mobile phone
- Devices that cause unbalance at transition
- Leaning over the side

Tripping or losing balance on an escalator can also lead to an entrapment which results in serious injury however this does not necessarily mean that there is a defect.

Hand injuries as a result of entrapment on escalators is a common accident so much so that Dr Campbell Reid, a surgeon, published a paper entitled "Escalator injuries of the hand" [8]



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Escalator injuries of the hand

D. A. Campbell Reid
Plastic and Jaw Department, The Royal Hospital Annexe, Sheffield

Summary
Three almost identical hand injuries in children riding on escalators are described. The mechanism by which these injuries were sustained is studied and the means for preventing such potentially disastrous occurrences discussed.

ALMOST identical injuries sustained by two small children in accidents on escalators have previously been briefly reported (Reid, 1968). A third child has now been treated.

CASE REPORTS

Case 1
A small 3-year-old girl was admitted to hospital having injured her right hand when it was trapped in the moving parts of an escalator in a department store. There was an extensive laceration across the dorsum of the right hand, and the extensor tendon to the middle finger was divided. An X-ray showed an undisplaced fracture at the base of the third metacarpal. An emergency operation was undertaken in which wound toilet was performed, the extensor tendon repaired with stainless-steel wire, the skin sutured, and the hand immobilized in plaster-of-Paris. Postoperative progress was uneventful, primary healing occurred, and the child regained full function in the hand.

Case 2
A small 4-year-old boy was admitted to hospital having injured his left hand on an escalator in a departmental store. The condition of the hand on admission is shown in *Fig. 1*. The extensor tendon to the middle finger was divided and those to the index and ring fingers partially divided. Wound toilet was performed, the extensor tendons repaired, and the wound closed by direct approximation of the skin edges.

Fig. 1.—Case 2. Initial injury.

Fig. 2.—Case 2. The hand 3 months later.

Fig 4: Medical paper on escalator injuries of the hand [8]

As with all risk management strategies the options available are to eliminate the risk or manage the risk.

Given that the risk in this context is the risk of a civil action against an escalator owner after an incident the current general strategy of owners is to attempt to mitigate the risk by apportioning blame towards the passenger. That is not a sound strategy when it comes to trying to achieve ALARP (as low as reasonably practicable)

Mistakes that escalator owners often make are that they leave themselves open to criticism for a number of reasons that may not be causative of the incident, including:

- Failure to maintain documentation
- Failure to maintain
- Failure to undertake periodic thorough examinations
- Failure to risk assess
- Failure to train staff
- Failure to specify adequately
- Failure to specify consistently
- Failure to follow procedures after an accident

Legal teams will ask for disclosure and the inability to demonstrate sound custodianship may open up a gap in the defence argument.

The fact of the matter is that the input by way of passenger actions to an accident may be as a result of easily identifiable misuse or by way of an innocent act or omission.

Escalator owners need to protect themselves against potential claims as a result of passenger inputs and the best option is to try and educate passengers. In the past documents such as the HSE PM34 [6] document “Safety in the use of escalators” aimed at educating passengers but in reality, such a

document never got to land on the breakfast table of most homes! The SAFed EMW guidance document [9] gives good advice but, again, it doesn't reach the coalface it only reaches those that are already well versed in escalator technology and safety.

In the UK LEIA have produced the "Liam loves escalators" [10] campaign and the SAFED EMW guidance [9] also provides good guidance. In addition, TfL have undertaken extensive research into improving escalator safety [11] as have other owners such as BAA [5] but still accidents are on the increase [2][3][4][5].

The US elevator & escalator safety foundation reaches school age children and educates them in how to use an escalator safely by attendance at educational establishments. Perhaps this is the only way the industry will reach those that need to be educated and hopefully they will pass on that education.

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BIOGRAPHICAL DETAILS

EurIng David Cooper

BSc (Hons), MSc, MPhil, CEng, FIET, FCIBSE, FRSA, FCGI, FSOE

David is a Chartered Engineer and Chairs the Educational Trust that manages these Symposiums. He has been in the lift & escalator industry since he left school in 1980. His MSc in lift engineering was awarded by University College Northampton and his dissertation was a study into accidents on escalators involving shopping trolleys His MPhil was awarded by the University of Northampton and his thesis was a study into accidents involving minors falling over the sides of escalators.