

Deflector Devices Enhance Safety on Escalators

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ABSTRACT

Since 1982 when safety deflector devices were first introduced on escalators in the UK, the product has gained recognition in many parts of the world. The inclusion of such devices to new specifications of escalators and retro-fitting to existing installations, has made escalator travel for numerous passengers, much safer. In many countries, the product is permitted to be installed, in others it is "illegal" - but under certain conditions can still be introduced and occasionally, in some countries, they are mandatory. There are benefits for all concerned by appropriate means being adopted in attempting to prevent serious injury when using escalators.

1. INTRODUCTION

It is nearly 20 years since the first safety brush deflector device was installed on an escalator at London Underground's Oxford Circus Station. Having been given a maximum of three weeks by some sceptics before the product would be destroyed by vandals wrecking it, hacking the filaments off with a razor or, setting fire to it, the installation is still complete, eighteen years on. Perhaps now though, a little dirty! Having lasted the first three weeks without incident, there was a mellowing of attitude and those raising doubt about the suitability and effectiveness of a brush mounted to the skirt panel of an escalator conceded that perhaps it did, just have a certain amount of merit. It was after this time, that the first 76 escalators with no skirt guard were then fitted with a brush deflector system. Subsequently, all escalators that had rubber skirt guards and all new installations, including the Jubilee Line extension, which is virtually complete have brush-guards. The total in service with London Underground is now around 400 machines.

London Underground Ltd., were the pioneers of adapting materials perhaps more closely associated (falsely) with the cleaning industry than with engineering or the vertical transportation industry, in particular. Most of the major escalator companies are now familiar with and probably have used a brush deflector system on at least some of their escalators. This is now a world-wide product, no longer in the exclusive domain of the United Kingdom.

2. BRIEF HISTORY

In order to have a solution, there must first be a problem. The problem that is universal in the world of escalators, is the possibility of side entrapment accidents. That being foot-ware, clothing and limbs being drawn into the running clearance between the step tread, or riser and the fixed skirting panel. Damage to shoes and clothes, whilst annoying, is of minor importance and can, perhaps be dismissed as an irritation and the cost implications being limited to just the value of replacements of the damaged articles. Those that escape lightly, without physical injury, are the lucky ones. But those for whom the chain of events only starts with damaged clothing the story is a little different. The casualties are invariably children between the ages of 3 to 12 or 13 years. They need not to have misbehaved, but in all probability were being responsibly supervised at the time. Their injuries range from superficial scratches and grazes to deep lacerations and even amputation of toes and legs. Recently, a young boy in the United States lost three toes in a side entrapment accident. The court initially awarded him US \$27,000,000 damages, but was subsequently reduced to US \$5,000,000 on appeal.

It is incumbent on us all, firstly to recognise the potential hazard and accept that accidents do actually happen. Secondly, all reasonable steps should be taken to minimise the risk, using modern technology and materials in order to show the world that by self regulation, responsible attitudes prevail in addressing these problems.

3. BRUSH DEFLECTOR DEVICES

The escalator brush deflector is a tactile warning device. Therefore it is interactive with those that come into contact with it. Passengers!

Generally, the device has been added to equipment not originally designed to accommodate it, but more and more it is being included as original equipment on many manufacture's machines. Latterly however, where a deflector device has been part of the new installation, for example in the UK and Hong Kong, the skirting and inner decking have now been designed to accept a version of the deflector, in its simplest form.

There are now a number of manufacturers of deflector devices in various parts of the world entering the market, offering a product ostensibly the same as or, perhaps even considered better than the original design concept, developed in England. In this commercial world in which we live, there will always be competition where it is perceived that it is healthy to be able to allow customers to have a choice. That is probably without doubt, although there may be a price to pay for choosing a cheaper alternative. One of the most important considerations is whether alternative sources are able to incorporate the same features, or whether for cost reasons they decide to miss out various fine design points. By attempting to sell a copy, invariably there is no evidence of that company being able to support the performance of their product.

Having personally been involved with escalator safety for about 16 years, I have seen a number of options and some of which have over simplified the device to the extent that it is a deflector in name only. Some would consider a row of toothbrushes meeting the needs of a safety product!

It has been my opinion that whilst having to fend off the sceptics that a deflector has any merit at all, when it is installed, it should be of good merchantable quality and complement the escalator design. It has to contend with:

- the rigours of everyday wear and tear,
- a considerable amount of abuse,
- requiring low maintenance,
- having a long life,
- minimising interference with routine maintenance of the escalator,
- not creating further tripping or trapping hazards and above all
- performing the function it is intended to do.

The elements of the product are usually in two parts, consisting of an extruded plastic, or generally preferred aluminium housing and the brush, with which passengers will make contact. The brush housing will be secured to the skirting by concealed fixing screws. It will have no sharp corners, but smooth angled faces will prevent the trapping of debris on the upper surface and feet under its lower surface.

Brush is usually synthetic, with fire retardant versions being available. Whilst fire retardant materials will burn within a fire, they do self extinguish when the source of the fire has been quenched. They also have the advantage of low toxic gas emissions, for it is more often the noxious gases which are responsible for causing deaths, than burning.

The positioning of a deflector device on an escalator is as important as the construction of the device itself. There are three main dimensions which are considered most important in order for the deflector to work at its optimum effect and without creating an additional hazard. These are:

- Incline clearance. The recommendation of Kleeneze Sealtech Ltd., which was determined by London Underground, is 8mm from the step nose to the nearest part of the brush housing.
- Landing clearance. The nearest part of the brush housing should have an increased clearance of 50mm.
- Comb Plate. From the intersection of the step with the comb plate, the nearest point of the deflector (i.e. end cap) should also be 50mm.

The rationale for these dimensions is:

- The deflector should be as close as practical to the step for maximum effect, without creating a trapping point and allowing for the permitted step tilt.
- The increased landing clearance prevents a "pinch point" when the steps transform from being fully formed to flat ingress and egress of the escalator.
- The comb plate clearance allows an escape route for those who have not heeded the warning of standing too close to the hazard zone, but have escaped pinching over the landing area and need to avoid being trapped by a triangular wedge, which could be created by extending the deflector over the comb plate, particularly when leaving the machine.

It is recognised that various code and standard authorities specify, for their own reasons, clearances which differ to those stated above. BS EN 115:1995 for example, requires 25mm step nose clearance, measured vertically. Hong Kong requires 15mm, but measured at right angles to travel. Whilst compliance with local codes is not a problem, it is often difficult to understand the reasoning, particularly when there appears to be no evidence to suggest there is a problem with the recommended installation clearances.

4. HOW DEFLECTOR DEVICES WORK

As such, the brush deflector really needs no further explanation for it to function. No signs or pictograms, no ethnic language translations, no Braille and no worries whether small children can read, understand and above all, do what the instruction states. It is functioning for the whole period an escalator is operational, 24 hours a day and 365 days a year.

The Institute for Consumer Ergonomics at Loughborough University in England, were commissioned by the UK Health and Safety Executive to study the behavioural aspects of escalator travellers. The lengthy and detailed study published in September 1989, showed, that in general, passengers treated an escalator with a deflector device in much the same way as one without. The main difference being however, was that when passengers felt the brush rubbing against their lower leg or ankle, they moved on average a significant 2 cm away from the hazard zone. It was also observed that there was a reduction of 50% of passengers travelling within 5 cm., of the balustrade. If painted lines (which are usually ignored) at the side of each step indicate that it is unsafe to stand in the painted area, the brushes enforce it .

5. CODES OF PRACTICE

Since the introduction of deflector devices for escalators in 1982, there was first an addendum to BS 5656 in the form of Guidance Note PM34, which required all new escalators to be supplied with a deflector device with effect from January 01, 1984. It also required that all existing installations should be retro-fitted with a deflector, where practical.

The British Standard has since been harmonised with the European Standard EN 115:1995. It states in para: 5.1.5.6.3 that in addition to the basic requirements for the prevention of side entrapments, deflector devices are permitted to be installed. Likewise, so are yellow lines permitted to be painted at the side of each step.

The three fundamental requirements in EN115:1995 for prevention of side entrapments in the design of an escalator shall include:

- The skirting to be rigid as specified in 5.1.5.6.2
- The skirt surface to be low friction by use of suitable materials
- The step to skirting clearance to be as stated in 11.2.1

When an escalator is first commissioned, those basic requirements are fine. However, the degree of friction is not qualified. I believe those fundamentals are essential in achieving the desired affect as a means of preventing side entrapments. However, as normal wear and tear take their toll, so the surface finish will be affected and will deteriorate. There will be a time when those three primary elements are not enough on their own, to prevent side entrapment accidents. The inclusion of a deflector device at the point of manufacture adds a minimal amount to the cost of an escalator and if a well designed product using good quality materials is used, it will probably last the life of the escalator.

The Electrical and Mechanical Services of Hong Kong Code of Practice 1993 requires all new escalators to be installed with a deflector device. The limitations of the overall sizes for the device and its position are clearly stated and as previously mentioned, the step nose clearance should be 15mm. Ironically, materials other than a brush are permitted. That which can be seen in a number of installations is a rubber “D” section profile. Although not specifically mentioned in the Hong Kong Code, I think it is ironical, because EN115 requires the skirting

to be low friction. To use a device for deflection purposes in a well known hazard area, rubber, by its very nature is a high friction material and has the opposite affect to guiding passengers away from the danger area. It is a false economy and a disaster waiting to happen.

Singapore's Code of Practice CP15:1990 acknowledges the deflector device in para. 6.1.5.6 and permits suitably designed brushes. However, there are no parameters for dimensional construction or positioning on escalators.

Australian AS 1735.5 recognises and permits deflectors to be installed and require step clearances of 25mm.

The current American ASME A17.1 and A17.3 Codes do not recognise brush deflectors as being a permissible addition to an escalator for the improvement of safety. However, in certain jurisdictions, by application for a variance order, a deflector device may be installed. There may be conditions attached, such as monitoring of incidents and for a report to be sent to the governing authorities' chief inspector on a monthly basis. The experience of casual reporting of performance of a deflector device has been most positive and favourable.

A thorough and detailed investigative study by Arthur D. Little, commissioned by the National Elevator Industry Inc., (NEII) has proposed an index rating for loaded step / skirting performance. This enables manufacturers, maintenance companies and inspectors to measure the skirt / step frictional resistance and loaded clearance gap. By reference to a table on a scale 0.0 to 1.0 it determines whether or not a deflector is required or, if a machine is compliant. As reported in Elevator World, (November 1999), Mr. Edward A. Donoghue, Code and Safety Consultant to NEII has submitted a request for a Technical Revision (TR) of the A17 code and proposed its adoption for ASME A7.1-2000 whereby any new escalator having an index of between 0.15 and 0.25 and any existing escalators to have an index of between 0.15 and 0.4 to have a deflector device installed.

6. BENEFITS

The benefits of providing a deflector device on all escalators is to improve further, the standards of safety expected by the travelling public. To be able to move freely from one place to another, by whatever means should not entail differing standards. Although the incidence of serious side entrapments is not high in proportion to the level of patronisation, the fact remains that when an accident occurs, it is usually very serious, possibly leaving the victim with major lacerations, broken bones, amputation and permanent disfigurement. A properly designed and installed brush deflector gently guides all passengers to position themselves in a safer spot away from the hazardous side of step entrapment zone. There has been a marked improvement in escalator safety in the UK since deflectors have become *standard* equipment. In one UK national newspaper it has been quoted that there were up to 40 side entrapments a year. Since deflectors have been installed, apart from minor incidents, this has dropped to nil.

From a maintenance company or manufacturers point of view, a preventative safety device will limit liability and therefore without incidents occurring, the machine operates for longer periods and reduces downtime. The reduction of costly and time consuming report writing and litigation allows the more productive use of the labour force.

7. CONCLUSION

The trend for a brush deflector device having been set by the United Kingdom, has now filtered to many places in the world. It has been used for 18 years without major incident and is becoming established as an industry standard in many countries. The varying attitudes shown by Standards Authorities indicates a need for such a device and in recognising this and probably according to the statistical evidence for their region, it determines how forceful the code is written. Where America used to consider such additions to escalators “illegal” they have now moved further than any other Standards Authority in researching and concluding that brush deflectors do constitute an important factor in contributing to the reduction of side entrapment accidents.

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9. BIOGRAPHICAL DETAILS

Barry Fowkes was trained as a fitter and draughtsman in mechanical engineering. Since completing an apprenticeship his working life has been spent mainly with security or safety. Having joined Kleeneze Sealtech Ltd., to promote and sell Escalator Safetystrip as a sales representative in 1984, he is now Divisional Manager with worldwide responsibilities to market this important safety device to the elevator industry and escalator owners. He has had papers published in *Elevatori*, *Elevation*, *Lift Report* and *Skylines* (US Building Owners and Managers Association Journal). Membership of industry associations include IAEE and National Association of Elevator Contractors (NAEC) - supplier member.