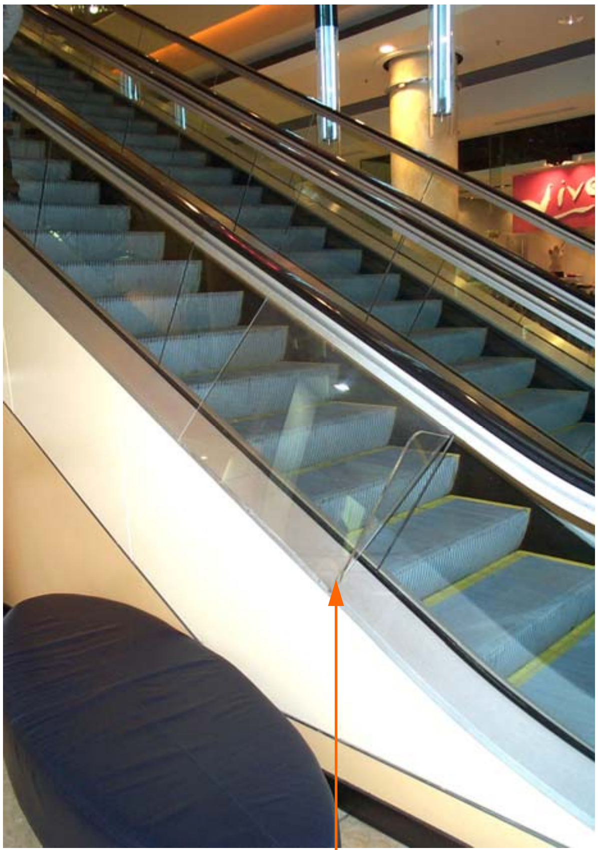
Escalator Points

by Graeme McRae

Child Guards - Does Size Matter?

Child guards are installed on escalators and moving walkways to prevent children, on the outside of the escalator, clinging to the handrail and being carried to dangerous heights. A number of injuries and deaths have occurred where the area at the side of an escalator was accessible and no guards were fitted.



Small Guard on escalator

Large Guard on moving walkway

Both guards :

- are constructed from clear, robust, plastic ~15 mm thick.
- have a section which extends to the outside of the truss and is intended to stop the child being carried past.
- are ~ 900 mm long to make it difficult for a child to climb around the guard.
- have rounded edges to minimise the chance of injury.
- are placed so the top of the handrail, on the lower side is ~ 1500 mm above the floor.

The larger guard has a significant advantage in that it extends to ~ 110 mm above the handrail; it therefore forces the child to let go of the handrail. With the smaller guard, depending on whether the child's elbow is bent, there is a possibility of the child being carried past.

So go for size but check you have the code clearance between the outside of the handrail and the guard.

Handling Capacity is not Proportional to Speed

A literature review shows the following:

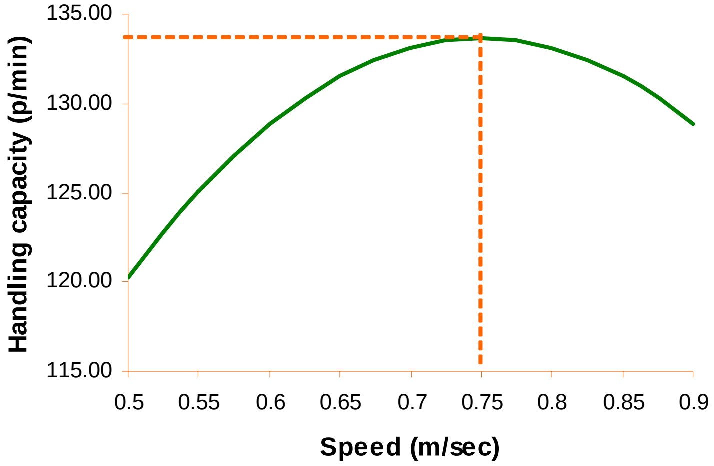
AS1735.5 : 2003, which is based on BS EN 115:1995, states that the theoretical handling capacity of a 1,000-mm-wide escalator is 13,500 passengers/hour (p/h) at 0.75 metres/second (m/sec) and 9,000 p/h at 0.5 m/sec. Actual handling capacities are much less as 2 people will not occupy each step.

Dr. Ing. Lutfi Al-Sharif surveyed 7 stations in the London underground railway. He observed that, at peak times, passengers would occupy every second step on the right side (where the British stand) and every third step on the left (where the British walk).

Dr. John J. Fruin developed the human buffer zone concept. People like to have an ellipse 610mm x 457mm to themselves to avoid touching others. As the 610mm dimension is across the shoulders, there is not space for people to stand side by side on a 1000mm wide step.

A. J. Mayo also did studies on the London underground observing that more people walk on short escalators and people stand closer together on slower escalators. Mayo derived an equation relating escalator speed (s in ft/min), vertical rise (h in ft) and traffic flow (t passengers/hour):

Maximum Capacity = $1.329s - 0.0055s^2 - 0.875h + 0.0112t + 0.0075hs - 11.2$.



If the height is say 12m and the traffic flow 5,300 passengers/hour, a curve, as shown to the left, results. A speed of 0.75 m/sec gives the greatest handling capacity.

The curve is quite nonlinear.

Paul Davis and Goutam Dutta surveyed escalator traffic at the ten busiest stations on the London underground. They derived a formula for 1,000 mm wide, 0.75 m/sec escalators:

Capacity = 124.76 – 0.47 rise (metres) – 8.05 (if part of parallel pair, 1 up & 1 down)
(p/min) - 6.90 (if there is a building corner near 1 side of the escalator)

Davis and Dutta showed that if speed is 0.75 m/sec, Mayo's equation becomes:

Maximum Capacity = $65.8675 + 0.2125h + 0.0112t$ which implies that as rise increases, capacity will increase. Their observations showed this was not true, so they suggested that the equation needed to be refined so the effect of h x s does not outweigh the effect of h.

References

Lutfi Al-Sharif, Escalator Handling Capacity. Elevator World Inc, 1996
John J. Fruin, Pedestrian Planning and Design. Elevator World Inc, 1987
A. J. Mayo, A Study of Escalators and Associated Flow Systems. Imperial College of Science and Technology, 1966
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