Minc Elevator Consulting - Specialist Expert Advice

Gold Coast High Rise - Lift Accident Investigation

Minc Elevator Consulting were contacted by the Body Corporate regarding an accident involving three passengers with one of the high-speed elevators. Minc Elevator Consulting issued a detailed investigation report, which necessitated entering the lift shaft and investigating the emergency braking distances.

This type of incident occurs, marks are visible on the rails in the lift shaft. These give an indication on stopping distance and associated G – Force.

The findings resulted in peace of mind for the customer and removed any liability and responsibility for the Body Corporate.

Excerpts from this Specialist Expert Report are below:

Safety Gear Activation (High Speed Emergency braking system)

The reason the lift stopped suddenly was due to the in-built safety gear activating, this device is triggered in the event of the lift over speeding and / or free falling.

Note:

1. This is a safety feature which is tested when the lift is placed into service, and it is a requirement to be re-tested on a regular basis.
2. Most electric lifts have this safety feature.
3. After the safety gear has been activated friction marks are evident on the lifting rails. These marks provide evidence of the distance over which braking took place.

The elevators were tested under the AS 1735 Part 2 Code.
The relevant settings for the operation of the Governor are:

Maximum electrical trip speed: 6.48 m/s
Maximum mechanical trip speed: 7.20 m/s
The Minimum and Maximum Stopping distances as a result of the Safety Gear operation is determined by the following formula.

$Smin = \frac{V^2}{2Fg} = \frac{7.2x7.2}{2x1.16x9.8} = \frac{51.84}{22.736}$ = ***2.280 meters***

Where F = 1.16

$Smax = \frac{V^2}{2Fg} = \frac{7.2x7.2}{2x.6x9.8} = \frac{51.84}{11.76}$ = ***4.408 meters***

Where F = 0.6

Legend:

F =	*multiplying factor for g*	*Smin =*	*minimum stopping distance in meters*
g =	*9.8 m/s*	*Smax =*	*maximum stopping distance in meters*
V =	*governor tripping speed in meters per second*		

As can be seen by the parameters in the above formula, the minimum stopping distance has to comply with the Statutory Code which is 2.280 meters. The actual distance indicated on the lift rails was 1.780 meters, which less than the minimum stopping distance and does not comply.

We believe that a slide distance circa the mid-range of 3.00 meters is preferable."

Indooroopilly Shopping Centre - Excessive Step Noise from Escalators

Minc Elevator Consulting were contacted by Mr Iain Smith on behalf of the Development Managers for the Indooroopilly Shopping Centre, after a complaint about the excessive noise from a number of escalators in the centre.

The noise in question was a loud knocking noise when customers travelled and walked on the Escalator steps.

Minc Elevator Consulting understands this is the 1st report on such an incident.

Every escalator installed in Australia has a level of step rock. All types of units use the same method of connecting steps to the step chain and all use very similar driving and guiding mechanisms.

There is no code or regulation requirement for the amount of step rock which is acceptable. Industry practice and standards would indicate that a dimension of 2-3 mm is acceptable level. This dimension is based on discussions with industry experts and inspections and measurements of units on site at Indooroopilly and off site at other locations across a wide range on Escalators.

Associated with the step rock is step rock noise which is mainly caused when excessive step rock is occurring, and the step pins are then able to hit the underside of the skirting.

Minc Elevator Consulting is of the opinion that 4 units installed at Indooroopilly fall outside the Industry Standard and fall outside the requirements of the specification Clause 11.2 as they do not travel smoothly throughout the travel without irregularities.

They do not operate quietly without appreciable mechanical noise.

Those units are Escalators 15, 16, 29 and 30. The last 2 being the Myer store units.

Excerpts from this Specialist Expert Report are below:

The investigation on site involved a detailed inspection of the 3 basic types of Escalators installed at Indooroopilly. Namely New Kone Escalators, Otis, and Schindler 9300.

The inspection involved removing several escalator steps and inspection the connection system of the Steps and the escalator step Chain driving and guidance system.

It also involved measurement of the step rock dimension on all units other that the David Jones Escalators.

This process was performed on the following Escalators on site:

- Escalator Number 10 (Schindler 9300)
- Escalator Number 5 (Otis)
- Escalator Number 16 (Kone Travel Master)

Schindler 9300 ESC Number 10	Otis Esca Aire ESC Number 5	Kone TravelMaster ESC Number 16	Kone TravelMaster ESC Number 23 not yet commissioned
			
Clearance 0 mm	Clearance 1 mm	Clearance 3 mm	Clearance 1.5 mm
Step Rock 1 mm	Step Rock 2 mm	Step Rock 5 mm	Step Rock 3 mm

All Escalators supplied and installed in Australia have a level of step rock.

One of the main contributing factors to escalator step rock is the ability of the step chain to move in the guiding or channel mechanism used to guide the step chain in the incline of the Escalator.*(see figure 1 & 2).*

Figure 1.

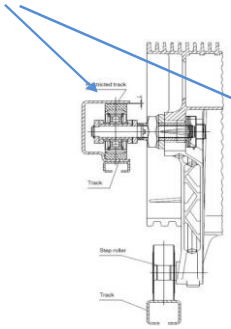
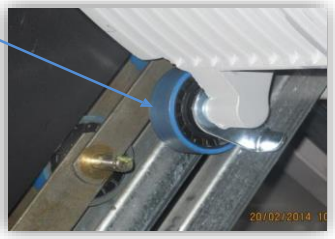


Figure 2.

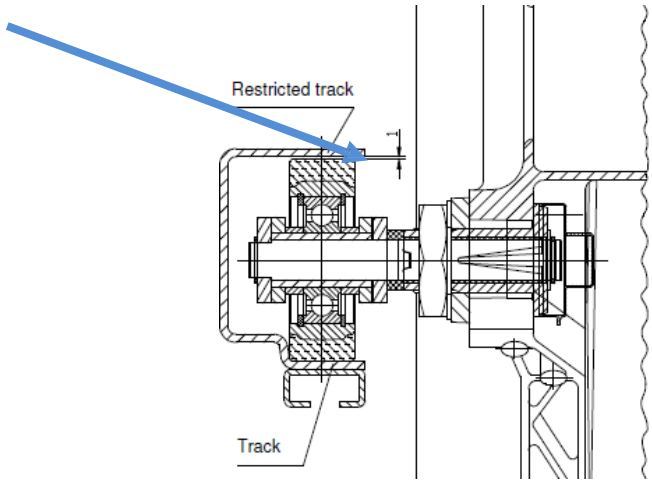


All escalator steps are directly connected to the Step chain. The step chain is guided through the guidance channel via rollers in the chain. If there is excess clearance between the step chain

rollers and the guidance channel the steps are permitted to rock and pivot and provide the perception of the steps rocking.

The recommended clearance between the top of the chain roller and the guidance channel is 1mm. *(see figure 3).*This is confirmed by 3 other major Escalator suppliers, Schindler, ThyssenKrupp and Anlev. *(Note: Anlev are a major supplier to Asia and other parts of the world and are a specialist Escalator manufacturers).*

Figure 3.



This dimension provides ample clearance for the step chain to run smoothly and as to not have pressure on the chain and prevent chain crabbing.

With a 1 mm clearance at the top of the roller the step rock is < 4 mm. This is within comfort and safety levels. This was found to be the case on the majority of the units at Indooroopilly and the units inspected at 3 other sites.

On 4 of the Kone Units at Indooroopilly (Units 15, 16, and Myers units 29 and 30) the step gap dimension was greater than 4 mm. These units are particularly noticeable with step rock and excessive noise from the step rock.

An inspection of Escalator 16 identified a clearance dimension of 3 mm between top of the Step Chain Roller and the Guidance channel. In the opinion of Minc Elevator Consulting this is deemed to be a contributing factor in the step rock dimension measured. *(See figure 4)*

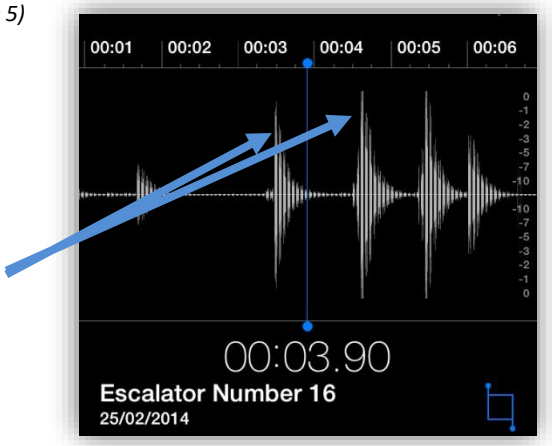
Figure 4.

It was also noticed that the Tension on the step chain on Unit number 16 may not have been as required by the manufacturer.

Escalators 15 and 16 also displayed an unusually loud knocking noise when passengers stepped on the escalator steps. This noise is well above acceptable levels and could contravene Clause 11.2 of the project specification.

An inspection of the Escalator determined the most likely source of the noise being the escalator step pin hitting the underside of the skirting due to the excessive clearance in the step chain rollers. *(See figure 5)*

Figure 5.



The guidance channels which house the step chains are manufactured and setup in the factories of each manufacturing company.

From the information that the companies were prepared to provide there is no scope to adjust this setup on site.

At the time of inspection all units were within the dimension required by AS 1735 – Part 5 for acceptable clearance between each step and therefore complied with the latest codes and regulations.

It is the opinion of Minc Elevator Consulting that units 15, 16, 29, and 30 do not meet the requirement of Clause 11.2 of the project specification. The major likely cause being the clearance dimension between the chain step roller and the guide channel of the step chain.

There may be other contributing factors, namely roller wear and chain tension.

Minc Elevator Consulting suggests that an acceptable standard be established when performing the final inspections of the Escalators at Indooroopilly Shopping Centre. The standard should be established to meet the requirements of Clause 11.2 of the specification.

Suggested standards are:

- Acceptable step rock dimension <4 mm.
- Acceptable Noise levels below 70 Dba from step rock noise.
- The above criteria be maintained throughout the Defects Liability Period.
- Completion of the Defects Liability Period will be subject to these standards being maintained.

At the current stage Escalators number 15, 16, 29 and 30, would be deemed not to meet these standards.

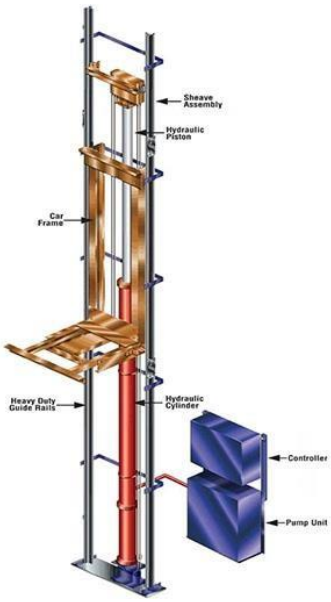
Brisbane - Lift Failure Investigation

Minc Elevator Consulting were contacted by a Body Corporate Chairman regarding an ongoing issue involving a passenger lift in a low-rise residential complex.

There are lifts for different functions e.g.:
1 Passenger lifts
2 Goods lifts
3 Service lifts

There are lifts using different mechanisms e.g.:
1 Traction lifts
2 Hydraulic lifts
3 Machine-room-less (MRL) lifts

This site had a Hydraulic passenger lift installed, this particular model incorporated batteries to power the lift operation and was continually trickle charged.



The ongoing problem was the lift was regularly locking itself out of service.

It was identified that the battery was going flat after several months in service, this occurred when the voltage dropped below specified operating values, this locked the lift out of service, necessitating a manual reset by a lift technician.

Initially the incumbent lift service provider changed the battery and when it next failed, they changed the charger, after a further failure the customer contacted Minc Elevator Consulting.

Minc Elevator Consulting conducted a detailed investigation, this necessitated taking extensive electrical voltage and current and power consumption measurements of all facets of the system.

The root cause why the lift was failing was identified that the trickle charge current was only marginally above the standby current required by the system, so after more than usual traffic the trickle charger could not top up the battery in sufficient time prior to the lift locking itself out of service.

Minc Elevator Consulting recommended getting a charger with a slightly higher capacity which was greater than the standby current consumed by the system and topped up any power consumed during use.

No further failures regarding charging / battery capacity were experienced after this upgrade.

The customer was extremely relieved that the root cause had finally been found and it was finally possible to fix the lift!