bca.gov.sg

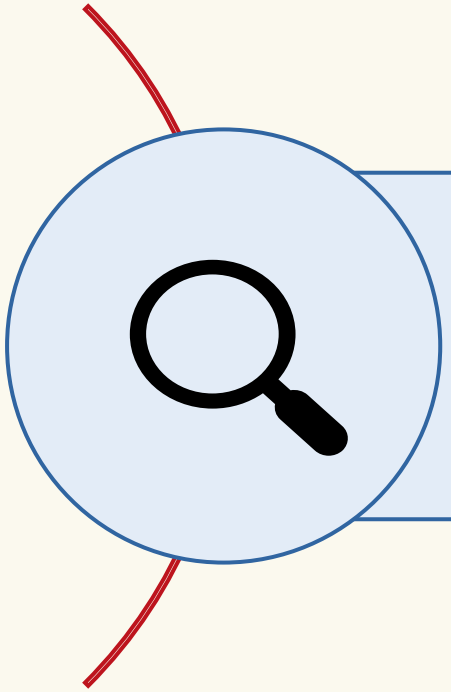
Elevating Safety Standards: Inspection, Innovation & Compliance

Jody Tan, Senior Engineer

Electrical and Mechanical Engineering Group - Investigation and Enforcement Department

(33 slides)

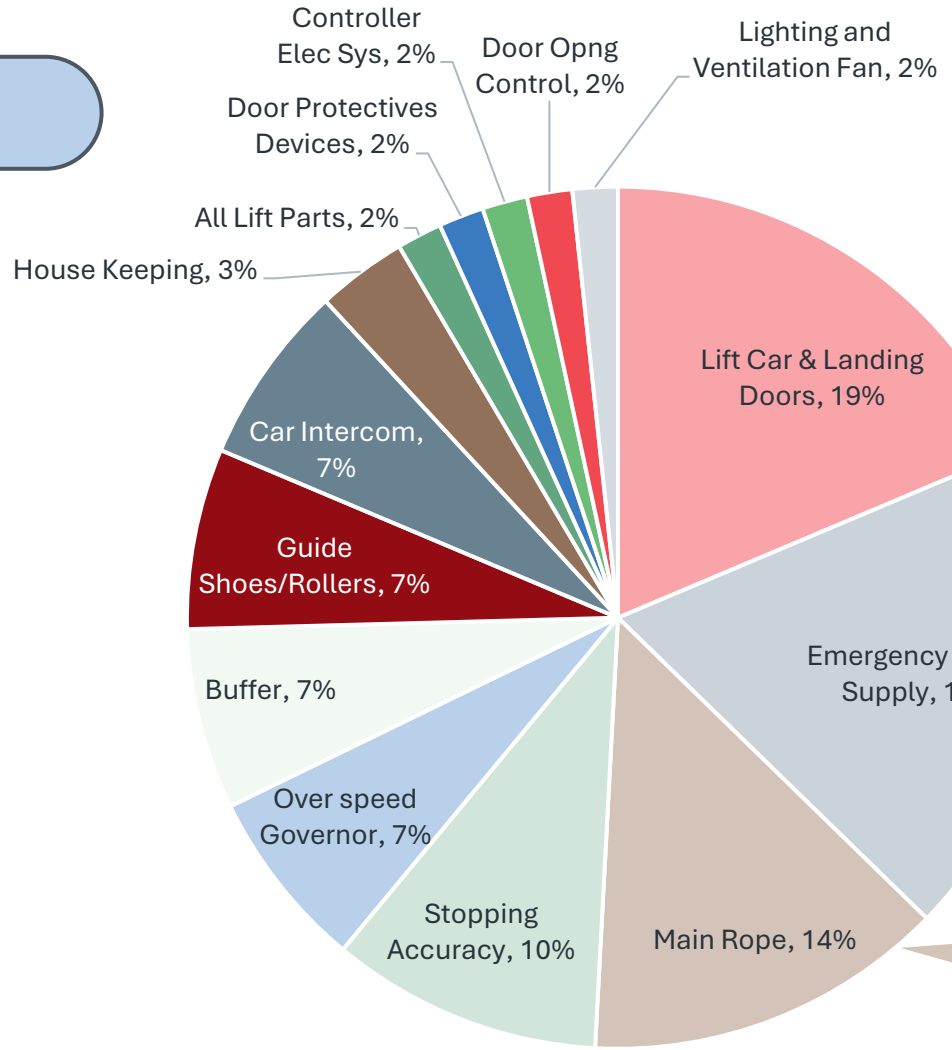
Table of Contents



1. KEY FINDINGS FROM INSPECTIONS

KEY FINDINGS FROM 2025 INSPECTIONS - Lifts

- These non-compliances represent genuine risks that require immediate attention.
- The internal deterioration of wire ropes is especially concerning as it can cause catastrophic rope failure.



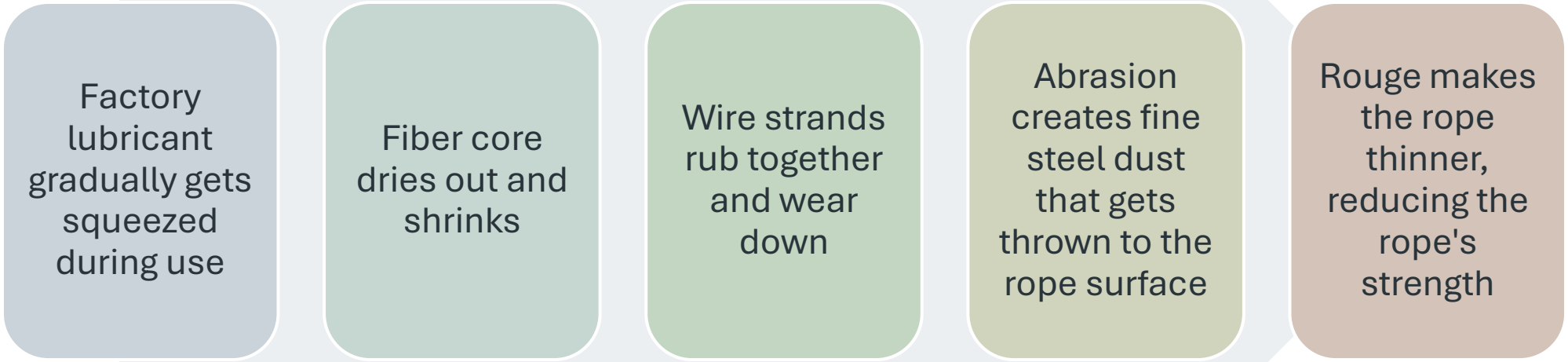
36% of the findings involved lift cars moving when a 25mm obstruction was introduced.

The lift car's lighting, ventilation or communication fails to function when the normal power supply is disrupted.

Rouging observed
Replace ropes before they exceed manufacturer limits or applicable standards.

What is Rouge?

Rouge is iron oxide that develops when the lack of lubricant allows fretting (abrasion between two or more un-lubricated wires). This abrasion creates steel particles that rust upon exposure to oxygen at the surface.



Difference between Rust and Rouge

- Surface **rust** doesn't always mean the rope is unsafe if it's well-lubricated internally and may still be serviceable.
- External **rouging** often hides worse internal damage, creating unexpected failure risk.
- Monitor continuously and replace if diameter reduction exceeds 3% of original diameter.

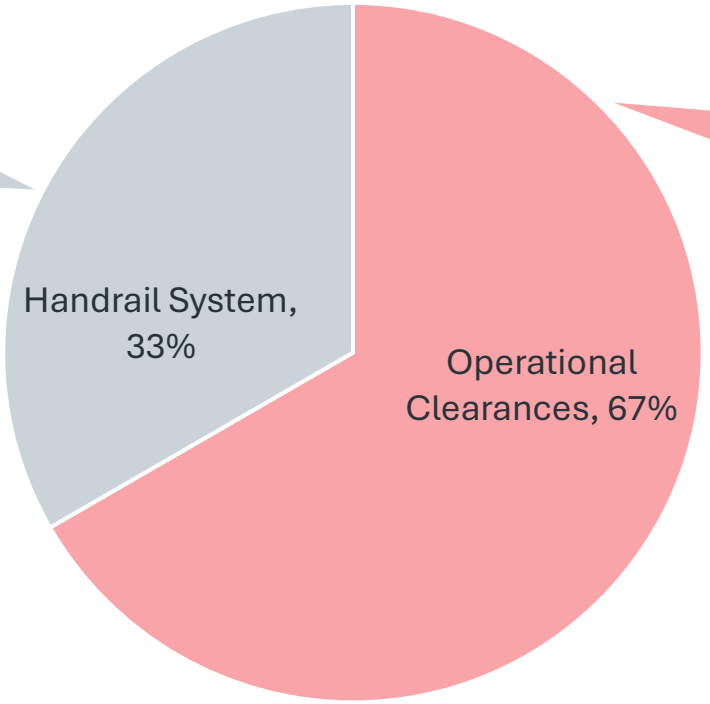
Feature	Rusty (General)	Rouging (Fretting)
Root cause	Environmental moisture	Mechanical micro-movement + oxidation
Appearance	Flaky, crusty, often thicker	Powdery, fine, often “dust-like”
Location	Mostly external	Internal contact points, valleys, sheave contact zones
Detection	Visual inspection	Often requires internal inspection (e.g., magnetic rope testing) or opening the rope
What it indicates	Lack of lubrication or coating failure	Wear, loss of internal support, improper bending/sheave conditions

KEY FINDINGS FROM INSPECTIONS - Escalators

2025 Non Compliances

Handrail intermittent Slippages

Property owners must keep their equipment in good working condition at all times.
Daily physical checks on the handrails should be conducted if handrail monitoring devices are not installed.



The gap between the skirt panel and escalator step exceeds 4mm.
The sum of both sides must be less than 7mm

Ensure regular checks and adjustments are conducted

Performance should be met until next maintenance visit

FI contractors must ensure that **maintenance standards are met until the next maintenance visit**. If required, FI contractors must open the skirt panel and inspect the conditions, as pull tests alone may not be adequate since they do not provide information on the condition of the components.

Important Takeaway

User safety depends on you

Performance Trends and Observations

Rising Non-Compliance Trend

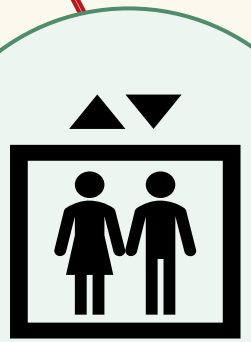
- There is a concerning upward trend in non-compliance rates across contractors in 2025

Industry Commitment Required

- Maintaining high standards demands ongoing commitment
- Proactive quality management systems and enhanced communication protocols needed to prevent further performance deterioration

Call to Action

- All contractors must strengthen internal compliance monitoring – complex, recurring issues must be escalated.
- Implement robust quality assurance processes to sustain performance improvements, for example, by sharing this presentation containing common site observations and part replacement guidelines during your management and technician toolbox meetings.



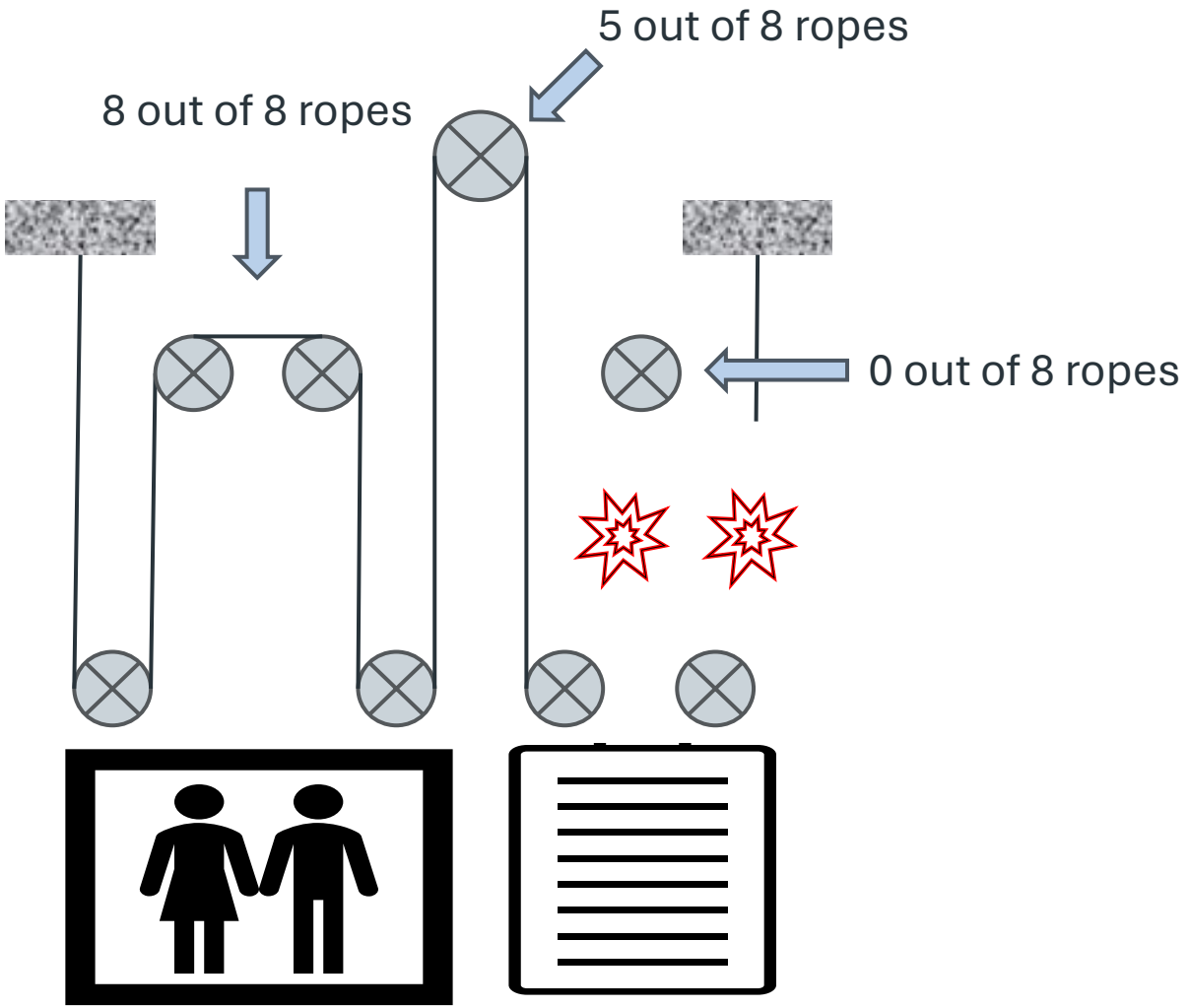
2. LEARNING POINTS FROM **INCIDENTS** - Lifts

Key Findings on Incident Lift

① Inadequate Bearing Sizing for Load Requirements

② Restricted Brake Linkage (Pivoting Point)

Case Study ① - Inadequate Bearing Sizing for Load Requirements



- All eight ropes supporting the lift car and counterweight broke, causing the counterweight to fall into the pit.
- The root cause was a seized counterweight bearing, undersized for its operating loads.

Case Study ① - Tell-Tale Signs

Train your technicians to recognise these signs during routine inspections

Audible

- Changes in normal operating **sounds**
- Unusual grinding, squealing, or rumbling from sheave area
- Intermittent clicking or knocking sounds

Visible

- Discoloured or dried-out lubricant
- Metal particles or debris around bearing area
- **Unusual wear** patterns on ropes
- Sheave wobbling or irregular movement

Case Study ① - Prevention Methods, Complete Action

Regular Maintenance

- Use **correct lubricant & lubricate bearings** that require lubrication according to manufacturer specifications
- **Replace** bearings timely
- Both car and counterweight sides operate under identical load conditions with similar wear patterns - replace the complete system as one unit rather than individual components.

Proper Installation

- Ensure **proper bearing sizing** for actual load conditions and lift expectancy
- Maintain **proper shaft tolerances** during installation
- Use appropriate mounting to **prevent misalignment**

Case Study ② - Restricted Brake Linkage (Pivoting Point) Tell-Tale Signs

Audible

- Grinding, squealing, or clicking sounds during brake operation
- Creaking or scraping when brake linkage moves

Lift over travel
Restricted brake linkage mechanism, which caused continuous friction between the brake pad and drum, leading to premature wear and eventual brake failure.

Visible

- Uneven, excessive, or accelerated wear on brake pads
- Corrosion, rust, debris buildup, or discoloured components from heat damage
- Metal filings, brake dust, or foreign objects in brake mechanism area
- Dry, hardened, or burnt grease at inspection points

Monitoring

- Jerky or rough braking instead of smooth deceleration
- Inconsistent stopping distances or positions
- Increased brake adjustments needed beyond schedule
- Longer stopping times or more frequent over-travel

Case Study ② - Restricted Brake Linkage (Pivoting Point) Prevention Methods

Lubrication System

- Apply specified grease to all pivot points*1, replace degraded lubricants, clean excess buildup.

*1: *To ensure that the grease does not drip or come into contact with brake pad or surface.*

Environmental Protection

- Remove debris, apply anti-corrosion treatments, check shaft cleanliness

Component Wear

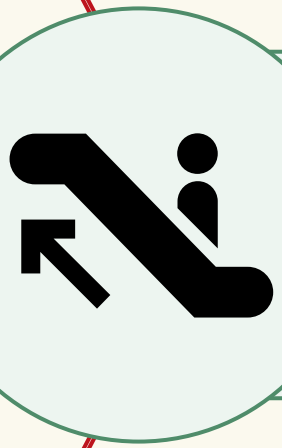
- Check bushings, linkage arms, springs for wear; measure clearances; replace worn parts

System Alignment

- Check component positioning, adjust misaligned parts, verify proper clearances

Overall System Health

- Full system inspection, performance testing, maintenance record review



2. LEARNING POINTS FROM **INCIDENTS** - Escalators

Key Findings on Incident Lift

① Escalator Brake Failure

② Failure of Handrail System

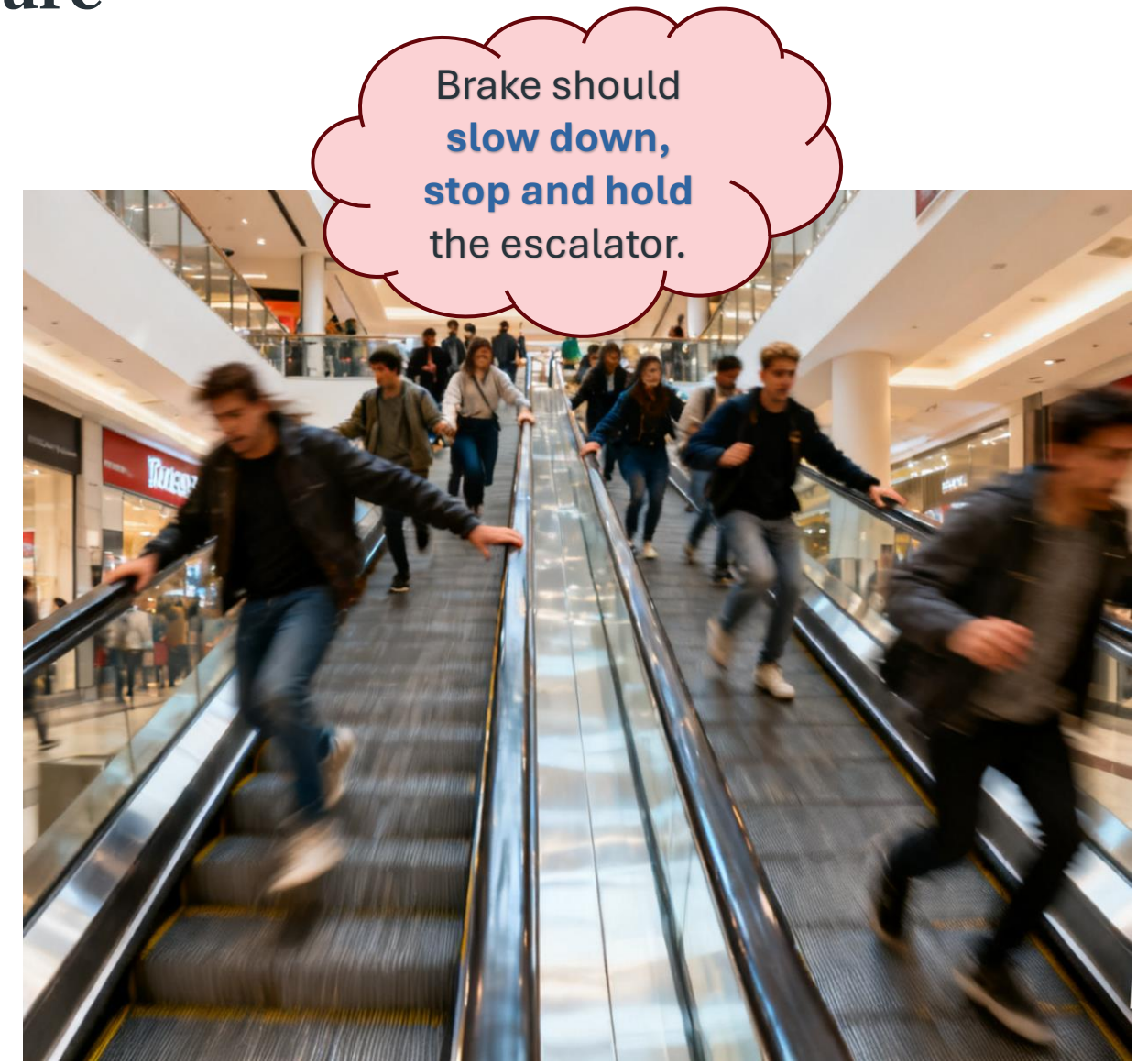
Case Study ① - Escalator Brake Failure

Types of Brake Failure Incident

- **Uncontrolled acceleration** – Escalator accelerates beyond normal operating speed in the downward direction.
- **Reversal** – Escalator reversed its intended direction
- **Inability to stop and hold** – Escalator continues running when it should stop

Causes of Brake Failure

- Mechanical wear of brake components, inclusive of Worn brake pads or brake shoes
- Improper brake adjustment or calibration
- Lack of regular inspection and testing



Case Study ① - Escalator Brake Failure

Understanding Different Brake Systems

Aspect	Lifts	Escalators
Brake Type	Same for both, Electro Mechanical Brakes	
Primary Function	Same for both, brakes hold the equipment in place and provide emergency stopping	
Normal State	Same for both, lifting/ disengaged during motion	
Activation Triggers	Same for both, activation during normal and emergency stops	
Usage Pattern	Multiple Start Stop (Every time when the lift stops)	Single Start Stop/ day* (Only activate during emergencies or at the end of the day when the owner stops its operation.)

* The symptoms of escalator brake performance are less detectable compared to lift brake performance, thus making testing more critical.

Case Study ① - Escalator Brake Failure

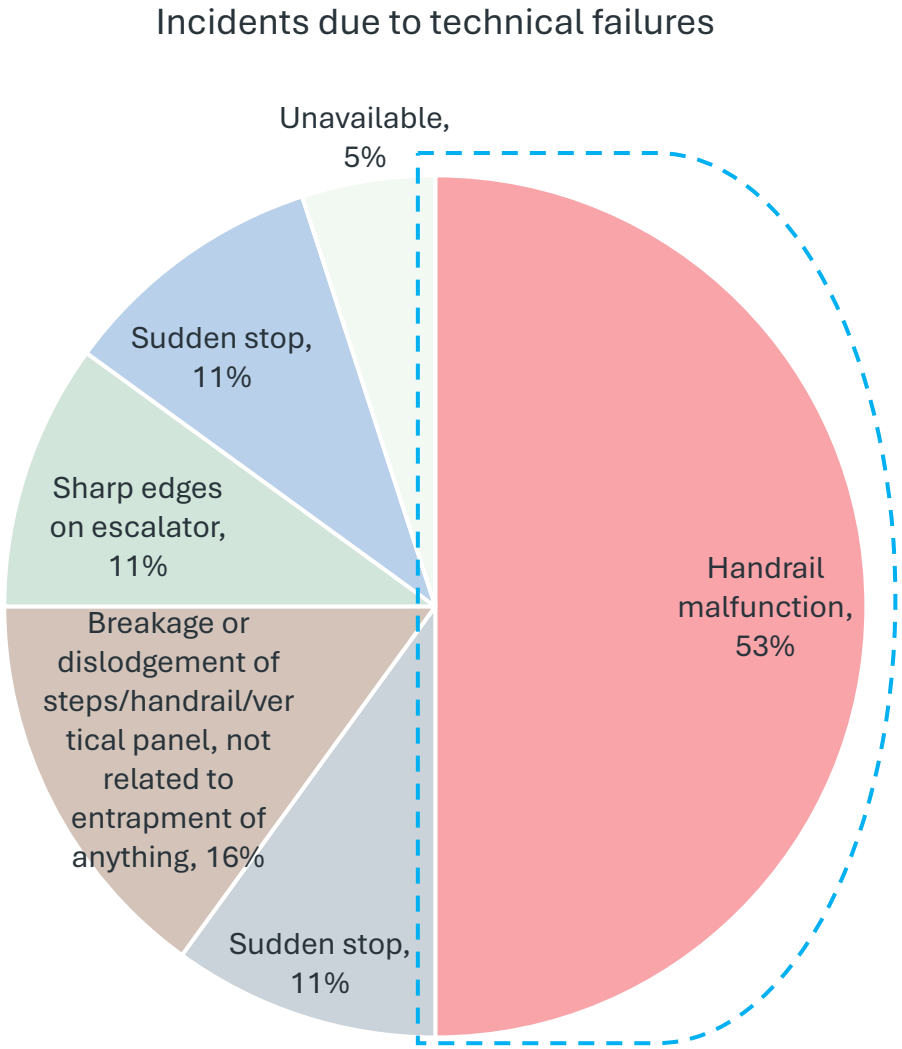
2025 Incident

- Escalator without auxiliary brakes
- Brake components replaced & no testing conducted
- The handrail inlet switch was triggered → the escalator stopped as designed.
- Passengers continued to use the out-of-service escalator, which had not been cordoned off after the incident
- Uncontrolled motion and overspeed under passenger load
- No backup system → uncontrolled acceleration downwards
- Near miss - passengers evacuated safely

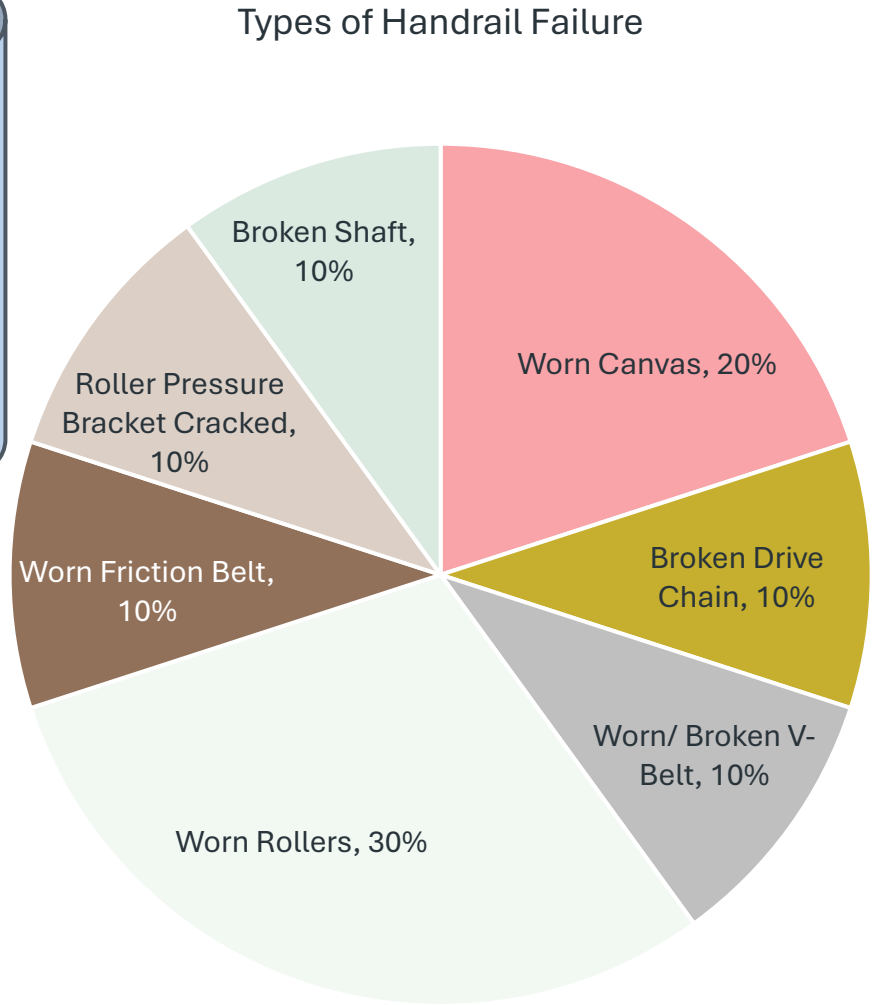
Full Load Testing Best Practices

- Conduct full load testing during T&C, after every brake replacement/ modification (major A&R), or adjustment
- Perform full load testing when taking over new maintenance projects - do not assume previous proper testing as the **liability is now on you**.

Handrail System Failure - 2025 Escalator Incidents due to Technical Failure



When conducting maintenance checks, inspect the entire length of the handrail for abnormalities, not just pull tests on one section.



BCA's expectation on maintenance

Performance should be met until next maintenance visit

Regular Maintenance

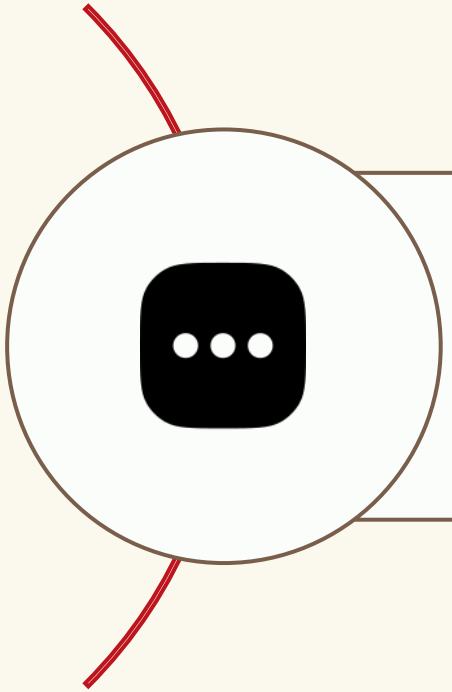
- Implement **frequent, scheduled inspections** of the entire handrail system
- Check for **wear, damage** and **proper tension** (according to OEM standards)
- Regularly verify **proper alignment** of the handrail with steps/ pallets. To address any misalignment promptly to prevent accelerated wear

Traceability

- **Track** the **age** and **usage** of handrail components
- **Replace parts proactively** based on manufacturers recommendations or wear indicators
- **Maintain** detailed **records** of all maintenance activities and **observations**
- Use this data to **identify trends** and potential issues before they become critical

Training, Quality of Parts

- Ensure maintenance staff are **properly trained** on handrail system specifics
- Provide regular **refresher courses** on best practices and common issues
- Use only manufacturers **approved** replacement **parts**
- **Verify compatibility** and quality of all replacement components



3. COMPLIANCE AND INSPECTION FRAMEWORK

Maintenance Outcomes Compliance

Maintenance Outcomes	Regulation 39(2) of the Building Control (Fixed Installations) Regulations 2025 (“BC (FI) Regs 2025”) punishable under regulation 39(7) of the same

- Refer to BCA's maintenance standards in BC (FI) Regs 2025, Fourth Schedule
- Ensure that maintenance standards are **met until next maintenance visit**
- Address problems before next service
- Ongoing compliance responsibility, not just during maintenance
- Regardless of maintenance frequency, **equipment must not fail** due to inadequate maintenance
- Report abnormalities to supervisor for investigation (e.g., uneven wear patterns)
- Non-compliance may result in regulatory action

The aim of this presentation is to share “BCA's expectations for service contractors to ensure that maintenance standards are met until next maintenance visit.” If there are doubts, service contractors should seek independent legal advice.

Examination, Inspection, Testing and Commissioning Compliance

EIT, EITC Specialist Professional Engineer Requirements	Regulation 35(1) of the Building Control (Fixed Installations) Regulations 2025 punishable under regulation 35(4) of the same

- Specialist Professional Engineer (SPE) or appointed Inspectors (LEI) must be present throughout inspection
- Verify correct setup and testing methods
- Provide guidance when methods are incorrect
- Ensure code compliance and proper testing
- Approve operation only after the SPE considers that the equipment is fit for operation
- Final safety approval rests with SPE

The aim of this presentation is to share BCA's expectations for Specialist Professional Engineer (SPE) supervision requirements. If there are doubts, SPEs should seek independent legal advice.

Examination, Inspection, Testing and Commissioning Compliance

Geotagging Process for EIT/EITC

- Login to LEAP using SingPass
- Scan QR code on PTO (or upload photo if poor network) **while at location**
- LEAP verifies GPS location if it matches equipment location
- Inspection details (date, time and location) logged into LEAP
- Telegrams and emails will be sent once geotagging is really for implementation

Safety Incident Reporting Compliance

INCIDENT REPORTING

Section 25B of the Building Control Act punishable under Section 25C of the same

- **Both** owner and last fixed installation contractor have **legal duty to report safety incidents** listed in the 2nd schedule of the Building Control (Reportable Matters) Regulations 2025 ("BC (RM) Regs 2025") to report to the Commissioner of Building Control **within 6 hours of becoming aware** or reasonably suspect incident occurred
- Gather all information required under BC (RM) Regs 2025, Reg 7(4) and report immediately **by calling** the BCA Hotline (**No** WhatsApp calls).
- 6-hour deadline starts when you first know or reasonably suspect incident occurred

The aim of this presentation is to share the responsibilities placed on both the owners and fixed installation contractors regarding reporting safety incidents listed in the Second Schedule of the Building Control (Reportable Matters) Regulations 2025. If there are doubts, please seek independent legal advice.

Safety Incident Site Preservation Compliance

PRESERVATION OF SITE	Regulation 42(2) of the Building Control (Fixed Installations) Regulations 2025 punishable under regulation 42(5) of the same

- **Preservation starts immediately** & ends only when BCA gives notice to release
- **Owner** has to take reasonable steps to prevent others from tampering with the site & secure the area to stop unauthorised access or changes
- **No person** shall alter, replace, remove or add any machinery or equipment that may have caused the incident, nor modify the incident scene in any way.
- Do not touch anything unless it is required to save lives or BCA has approved it.

The aim of this presentation is to share the responsibilities placed on both the owners and fixed installation contractors regarding preserving safety incident sites. If there are doubts, please seek independent legal advice.

Ensuring Safe Operation of the Fixed Installations
Circular APPBMSMA-2023-02 (4 September 2023)

Escalators

Regulation 38(1) of the Building Control (Fixed Installations) Regulations 2025 punishable under regulation 38(7) of the same

- Handrail belts are properly tensioned
- Speed difference between handrail belts and steps
- Escalator steps are free from debris
- Escalator sides are free from sharp protrusions that could injure users

OWNERS
Keep Fixed Installation in good Working Condition at all times

Installing Handrail Speed Monitoring Devices to provide real-time monitoring and automatically stop the escalator if abnormalities such as handrail stoppages are detected

The aim of this presentation is to share the responsibilities placed on owners to ensure fixed installations are in good working condition. If there are doubts, please seek independent legal advice..

Ensuring Safe Operation of the Fixed Installations
Circular APPBMSMA-2023-02 (4 September 2023)

Lifts

Regulation 38(1) of the Building Control (Fixed Installations) Regulations 2025 punishable under regulation 38(7) of the same

- Door open buttons are working as intended
- Door edge protection devices (e.g., safety edges, light curtains)
- are operational
- Alarm bell and intercom system are functional
- Lift lighting and ventilation fan are in operation.

OWNERS
Keep Fixed Installation in good Working Condition at all times

The aim of this presentation is to share the responsibilities placed on owners to ensure fixed installations are in good working condition. If there are doubts, please seek independent legal advice..

Fixed Installations Maintenance Outcome Guidebooks

https://www1.bca.gov.sg/resources/guidebooks-and-publications/fixed-installations-maintenance-outcome-guidebook/

Lifts

Building and Construction Authority

LIFT MAINTENANCE OUTCOME GUIDEBOOK

Escalators

Building and Construction Authority

ESCALATOR MAINTENANCE OUTCOME GUIDEBOOK

Vertical Platform Lifts

Building and Construction Authority

VPL MAINTENANCE OUTCOME GUIDEBOOK

1. The Fixed Installations Maintenance Outcome Guidebooks provide the industry with detailed illustrations and explanations of the maintenance requirements specified in the Fourth Schedule of the Building Control (Fixed Installations) Regulation 2025.
2. However, this information is not exhaustive and contractors should exercise professional judgement and refer to relevant codes, standards, and manufacturer specifications to ensure comprehensive compliance with all applicable requirements.

Transition to DSP Inspections and Risk-Based Inspection Regime

Digital Submission Programme (DSP)

Why This Change?

- Promotes contractor self-assessment
- Enables efficient resource allocation

Inspection Focus

- Compliance with Maintenance Outcomes requirements in Regulation
- Same standards as physical inspections
- Consistent safety and performance expectations

What to Expect

- Submit photos/videos through FormSG platform
- No physical inspections if submissions are in order
- No equipment shutdown or technician deployment
- Flexible 5-month timeline
- Multiple submission methods available
- Notify officers when completed
- Performance-based eligibility

Transition to DSP Inspections and Risk-Based Inspection Regime

Risk-Based Inspection Regime

Why This Change?	Risk-Based Inspection Focus	Timeline	What to Expect
• Handrail failures are the major contributor to escalator incidents • Proactive safety management to prevent incidents	• Targeted Maintenance Outcome inspections on handrail systems	• Starting from Jun 2026 for a period of half a year.	• Advance notification of inspections • Extended time requirements for comprehensive evaluation

Building and Construction Authority

Thank You

@BCASingapore