Condition Assessment Report

Inspection of Polytechnic Lift Glass Panel Defect



PHYSICAL FACILITIES DEVELOPMENT SECTION
MINISTRY OF EDUCATION, HIGHER EDUCATION AND SKILLS DEVELOPMENT
MALE', REPUBLIC OF MALDIVES

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Inspected By:

Physical Facilities Development Section,
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1. Executive Summary

- Building Name: Maldives Polytechnic Building
- Location: Rehendhi Hin'gun, Galolhu, Malé, Maldives
- Owner/Agency: Ministry of Education, Higher Education and Skills Development
- Building Type: Educational /Technical and Vocational Education and Training Facility
- Inspection Date: 23 August 2026

An engineering condition assessment was conducted on the shattered structural glass panel of the Machine Room-Less (MRL) elevator hoistway tower. The affected panel is located within an indoor atrium directly beneath a large, translucent skylight canopy. The investigation reveals that while the 2 x 6mm double tempered laminated safety glass successfully performed its code-mandated containment function—preventing structural collapse into the shaft—the system suffered a catastrophic tempering fracture due to a combination of **restrained thermal expansion, inadequate edge cushioning, and structural micro-vibrations**.

Immediate replacement following revised glazing protocols is required to restore full structural integrity to the enclosure.

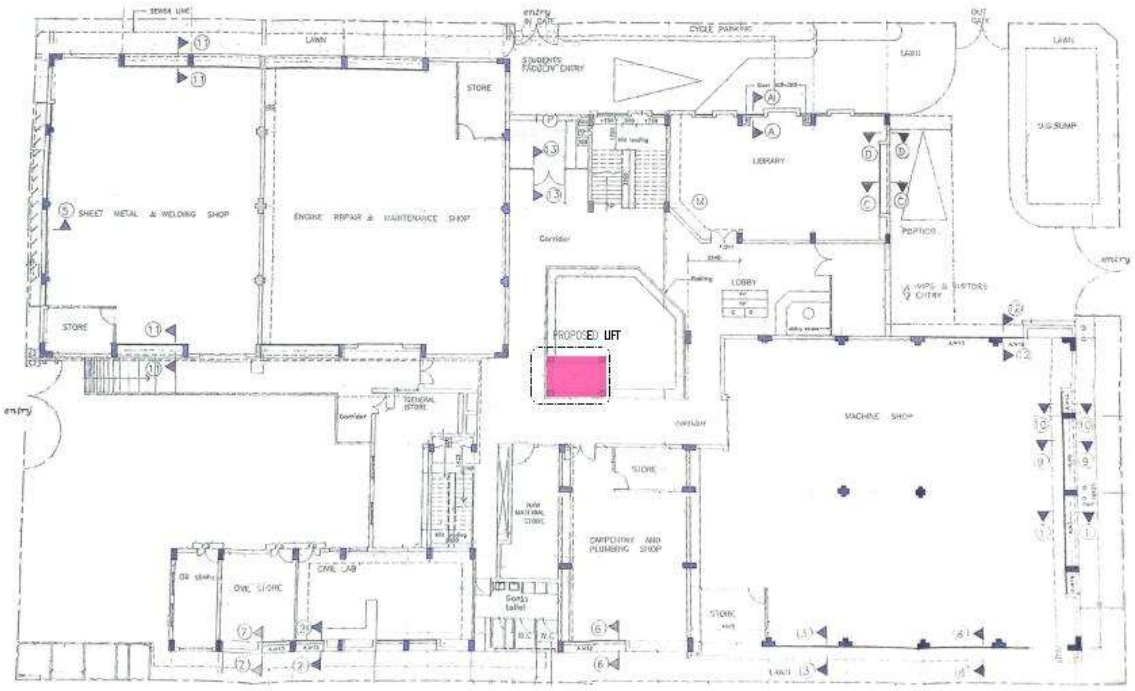


Figure 1- Ground floor plan with elevator location

2. Purpose

A report was received indicating that a large glass panel installed at the elevator hoistway is damaged and requires an urgent condition assessment.

3. Assessment Objectives

- To assess the current condition of the damaged glass panel installed at the elevator shaft.
- To identify the extent and nature of the damage, including cracks, fractures, or other visible defects.
- To evaluate the potential safety risks associated with the damaged glass panel, particularly the risk of glass failure or falling debris.
- To determine whether the existing glass panel can be repaired or requires complete replacement.
- To recommend appropriate remedial measures to ensure the safety, stability, and proper functioning of the glass panel and its supporting frame.
- To recommend suitable monitoring and maintenance measures to identify any further deterioration or defects

4. System and Component Specifications

Based on the approved shop drawings and compliance matrix documents, the architectural and structural parameters of the installation are as follows:

- **Elevator Type:** Machine Room-Less (MRL), 1000kg rated capacity (13 PAX).
- **Structural Framing:** Steel-framed vertical tower truss with diagonal structural bracing (35mm x 2mm CHS).
- **Glass Specification:** Approved revision from monolithic 12mm tempered to **Double tempered laminated safety glass (2 x 6mm)**.
- **Fixing Mechanism:** Multi-tier vertical stack supported by welded flat steel glass supports and custom Z-shaped glass brackets, completed with an interior decorative SS 316 profile.
- **Sealing Interface:** Two layers of 8mm black sponge tape on the interior flange and thin transparent rubber gaskets flanking the glass edges within the Z-bracket seats.

5. Visual Observations and Damage Description

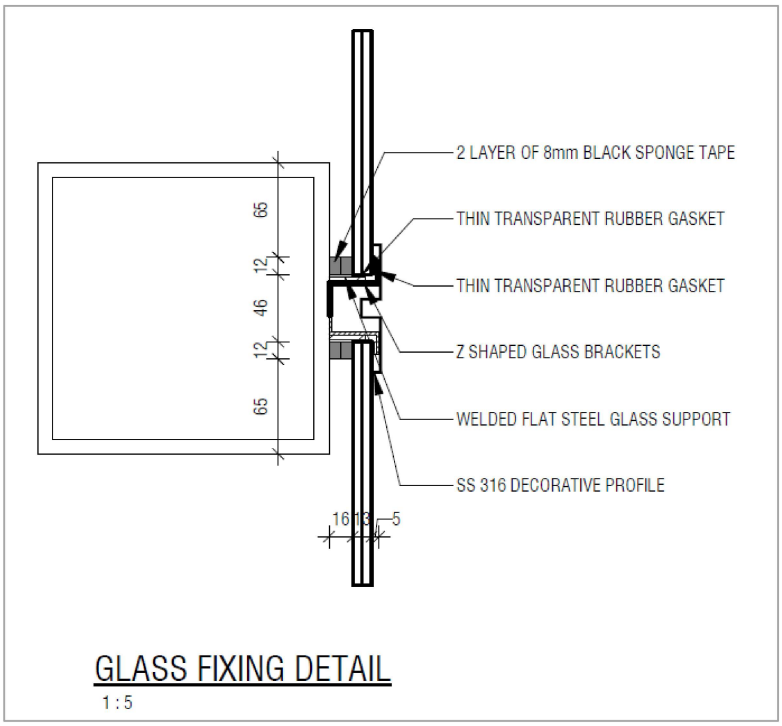
Fracture Pattern: The damaged panel exhibits a dense, highly uniform "spiderweb" or diced fracture configuration across 100% of its surface area. This fracturing behaviour is typical of fully tempered glass experiencing a release of internal tensile stresses.

Post-Fracture Behaviour: The panel remains entirely bound within its perimeter tracking and point-supports. The internal plastic interlayer (lamination) has successfully retained the structural fragments, preventing an immediate breakthrough hazard or debris shedding into the hoistway or the public atrium floor.

Deformation: The panel shows minor localized sagging near the horizontal support seams due to the complete loss of individual glass layer rigidity, compromising its long-term resistance to localized air-pressure loading (piston effect) from the elevator cabin.

6. Engineering Causation Analysis

A cross-examination of the visual damage, structural layouts, and the approved *Glass Fixing Detail* drawing isolates three primary contributing factors to the failure:



Possible Causes:

A. Restrained Thermal Expansion (Greenhouse Effect)

Although the elevator tower is technically located indoors, it is positioned directly beneath a massive overhead translucent skylight canopy (canvas material). This architectural layout apparently creates a severe micro-climate characterized by intense solar radiant heat and high thermal gain. Fully tempered glass expands linearly under heat.

B. Defective Glazing Clearance and Rigid Contact Points

The *Glass Fixing Detail* demonstrates a fatal mechanical flaw: the upper glass panels sit in a stacked orientation where the dead load and expansion forces bear down onto the horizontal steel flange of the Z-shaped bracket. The drawing specifies only a "thin transparent rubber gasket" at this boundary.

- Thin plastic or PVC gaskets possess virtually no elastic compressibility.
- As the glass expanded under the intense radiant heat from the skylight, it completely consumed the clearance gap.
- The rigid steel Z-bracket acted as an unyielding restraint, concentrating severe stress directly onto the highly sensitive, cut edges of the tempered laminate.

C. Mechanical Vibrations and Structural Loading

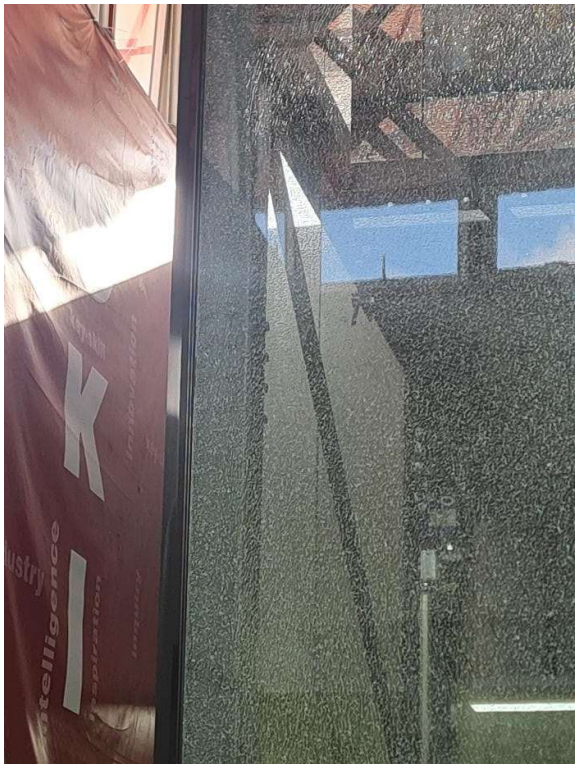
As an MRL lift system, the structural guide rails are tied directly to the vertical steel frame components. The natural micro-vibrations and horizontal deflections generated during cabin

movement travel dynamically through the welded steel glass supports. Because the interior interface relies on "8mm black sponge tape" (which degrades and loses elasticity when subjected to high-temperature UV exposure from the skylight), the panel lacked dampening. The structural vibrations directly ground the expanding glass edge against the hard steel Z-bracket boundary, initiating the fracture.

Note: A contractor at the site informed us that there are typically one or two defective glass panels in every shipment of 100 panels received from the manufacturer.

7. Photographic Record











8. Recommendations

Remove the existing defective glass panel. The entire glass panel is recommended to be replaced, as it is severely damaged due to extensive cracking.

Provide a new glass panel and securely connect it to the existing frame using an approved/revised fixing method.

Conduct frequent inspections to identify any further defects or signs of damage to the glass panels.

To safely execute the repairs and prevent a recurrence of the same failure on the new panel or adjacent panes, the following remediation protocol is recommended to help prevent similar incidents in the future.:

Isolate and Stabilize: Immediately take the elevator out of service. Cordon off an exclusion zone directly under the vertical column of the damaged pane. Apply a heavy-duty, pressure-sensitive stabilization film across the exterior face of the fractured panel prior to mechanical removal to mitigate fragment shedding.

Modify the Glass Fixing Detail: Reject the reuse of the "thin transparent rubber gasket" at all horizontal bearing seats. The replacement panel must be installed using High-Durometer EPDM or Neoprene Setting Blocks (80–90 Shore A Durometer) with a minimum thickness of 6mm (1/4 inch). This will provide a compressible cushion that accommodates both the dead load of the pane and dynamic thermal expansion.

Replace Sponge Tape with Structural Silicone: Replace the perimeter 8mm black sponge tape with an engineered Structural Silicone Sealant and compatible backing rod. This creates a flexible, UV-stable joint capable of dampening elevator cab vibrations without hardening or degrading under the skylight canopy.

Mandate Factory Heat Soak Testing (HST): The replacement 2 x 6mm double tempered laminated panel must undergo a certified Heat Soak Test (per EN 14179 or equivalent) at the manufacturing plant. This destructive testing phase forces panels with unstable nickel-sulfide (NiS) inclusions to break at the factory rather than under the solar load of the atrium.

Calibrate Hardware Torque: Ensure all fastening bolts on the SS 316 decorative profiles and Z-brackets are tightened using calibrated torque wrenches to the precise engineering specifications provided by the glazing manufacturer, eliminating localized clamping stresses.