

Briefing: MRT Orange Line Platform Screen Door Prototype & Life Cycle Test Procedure Review

Executive Summary

This briefing document provides a comprehensive synthesis of Submission No. PSD-40002.B, which details the test procedures for the Functional Prototype and Accelerated Life Cycle of the Platform Screen Doors (PSDs) for the MRT Orange Line Project (Bang Khun Non – Min Buri Section). The submission, dated August 5, 2025, represents a significant revision (Rev. B) of the initial procedure, incorporating detailed feedback from key stakeholders including CH. Karnchang (CK), Bangkok Expressway and Metro (BEM), and the Mass Rapid Transit Authority of Thailand (MRTA).

The core of the revision is a response to a comprehensive Comments Review Sheet containing 47 specific points. The dialogue between the supplier consortium (led by Siemens Mobility and ST Engineering) and the project stakeholders has resulted in a more robust and exhaustive testing protocol. Key themes from the review include a demand for greater documentary rigor, enhancements to test methodologies, an expanded scope for safety and functional checks, and detailed clarifications on the 1-million-cycle endurance test.

Ultimately, the revised procedure incorporates numerous critical updates. These include the addition of previously missing annexes and detailed component drawings, the expansion of test criteria to cover more scenarios and safety features, and the formalization of remote monitoring via CCTV for tests conducted in Singapore. The outcome is a thoroughly vetted test plan designed to validate the PSD system's performance, reliability, and safety prior to the commencement of full-scale manufacturing.

1. Project and Document Overview

- **Project:** MRT Orange Line Project, Bang Khun Non – Min Buri (Suwinthawong) Section
- **Contract:** M&E Equipment Contract
- **Subject Document:** Submission No. PSD-40002.B; "Test Procedure - PSD - Functional Prototype and Accelerated Life Cycle" (Document No. ORL-STE-PSD-PRC-40000002_B)
- **Purpose:** To conduct a type test before production to ensure the functionality of both Half-Height (HHPSD) and Full-Height (FHPSD) Platform Screen Doors meets design and contract requirements. The procedure also outlines an accelerated life cycle test to verify the endurance and physical wear of components over one million operational cycles.
- **Test Location:** ST Engineering Urban Solutions Ltd., Singapore.
- **Key Stakeholders:**

- **Supplier Consortium:** Siemens Mobility (SML, SMOG, SMOA, SMT), ST Engineering Urban Solutions (STE (TH)), Bozankaya (BOZ).
- **Client / Reviewers:** CH. Karnchang Public Company Limited (CK), Bangkok Expressway and Metro Plc. (BEM), Mass Rapid Transit Authority of Thailand (MRTA), PCOR.

2. Analysis of Stakeholder Review and Resolutions

The evolution from the initial test procedure (Rev. A) to the current version (Rev. B) was driven by a detailed review process captured in the Comments Review Sheet. The feedback and subsequent actions are categorized below.

2.1. Documentation and Procedural Rigor

Stakeholders requested significant enhancements to the completeness and clarity of the test documentation.

- **Missing Annexes:** The initial submission was missing a "Punch List" and an "Attendance Sheet". These have been added as Annex E and Annex F, respectively.
- **Additional Drawings:** Multiple requests for drawings were fulfilled, including:
 - Detailed drawings of the HHPSD/FHPSD test stands (Annex G).
 - Drawings for the Driver Local Control Panel (DLCP) (Annex G).
 - Layout drawings for the complete prototype setup (Annex G).
 - Detailed drawings for the LCD Enclosure (Annex G).
- **Reference Documents:** It was noted that "PSD-40001 PSD -Subsystem Test Plan" was missing from the reference list. It has been added to the revised document.
- **Software Versioning:** A requirement to record the specific software version of the Portable Test Unit (PTU) used during testing was added to the procedure.
- **Terminology Consistency:** A discrepancy in designating MRTA as an "Observer" in one section and a "Witness" in another was identified. The terminology was aligned, with MRTA now consistently referred to as a "Witness".

2.2. Test Scope and Criteria Enhancement

The scope of testing was expanded to cover additional components and safety criteria.

- **Expanded Functional Tests:** Testing was broadened to include the Driver Local Control Panel (DLCP) and the isolation function of the Emergency Egress Doors (EED).
- **Enhanced Safety & Quality Inspections:** New inspection criteria were added to the visual checks for both HHPSD and FHPSD prototypes:
 - Verification that no abrupt irregularities or sharp edges are present.

- Confirmation that coating color matches the approved color code and is free of cracks or damage.
- Measurement of coating thickness to ensure it meets the minimum 60µm requirement.
- **Expanded Dimensional Checks:** Dimension verification was expanded beyond the main doors to include related components such as the Crowd Guide, Anti-Climb features, and Rear Cover.
- **Subcontractor Approval:** It was clarified that written approval from CK/BEM will be sought for the major subcontractor responsible for manufacturing the PSDs before prototype testing begins.

2.3. Test Methodology and Monitoring

Specific methodologies and the means of observation were refined based on stakeholder feedback.

- **Remote Monitoring:** A key requirement was established for the use of surveillance CCTV for remote monitoring of the continuous life cycle testing conducted in Singapore. This was accepted and updated in the procedure.
- **Force Measurement:** A suggestion to use a dual-measurement approach (force gauge plus a pinch force meter) to improve reliability was discussed. The supplier maintained that their standard method using a force gauge is accurate, but agreed to use a gauge with an optional handle to mitigate human error, as discussed in a workshop.
- **Clarified Procedures:** Details were added to clarify specific test actions, such as how to connect the linear encoder to the doors, the precise measurement point for the handheld tachometer, and specific test points for insulation and bonding tests.

2.4. Accelerated Life Cycle Test Protocol

The protocol for the 1-million-cycle endurance test was a focus of several clarifications.

- **Inspection Protocol:** Stakeholders (BEM, CK, MRTA, PCOR) will be formally invited to witness inspections via online remote access at key milestones: 250,000, 500,000, 750,000, and 1,000,000 cycles.
- **Preventive Maintenance (PM):** It was clarified that no scheduled PM tasks will be performed during the endurance test. Maintenance will only be conducted if a component is found to be significantly out of specification during an inspection. Any such activity will be formally recorded in the event log.
- **Component Checks:** The "stopper pin" was explicitly added to the list of Drive Unit and Mechanism components to be checked during inspections.
- **Pass Criteria:** The pass criteria for the event log was defined as the absence of any "fatal alarm" being recorded in the HMI or error log throughout the 1-million-cycle test.

2.5. Clarification of Test Boundaries

Several comments sought to clarify what was included within the scope of this specific test procedure.

- **Power Distribution Panel (PDP):** The PDP is not part of this prototype test. It will be validated during a separate Factory Acceptance Test (FAT), to which participants will be invited.
 - **Mechanical Loading:** A request for a Mechanical Loading Test was addressed by clarifying that load conditions (e.g., crowd pressure) are accounted for in a separate structural analysis, with reports to be submitted in "PSD-40004".
 - **Weather Tightness:** A Weather Tightness Test is not included; instead, IP rating type-test certificates will be provided under the "PSD-40004" submission.
 - **PSI Brightness:** A formal brightness test for the Platform Summary Indicators (PSI) will be conducted during dynamic on-site testing with the actual train and crew, not during this prototype test. A visual check will be performed.
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3. Key Technical Specifications and Test Parameters

The test procedure document outlines a rigorous set of performance criteria that the HHPSD and FHPSD prototypes must meet.

3.1. Core Performance Requirements

Parameter	Requirement
Door Motion	
Door Opening Time	< 3.0 seconds
Door Closing Time	< 3.5 seconds
Maximum Door Speed	< 0.5 m/s
Maximum Closing Force	< 140 N
Safety & Endurance	
Obstacle Detection	Minimum 10 mm gap
ERM/EED Unlocking Force	≤ 67 N
Manual Door Opening Force	≤ 133 N
Accelerated Life Cycle	1,000,000 cycles
Operational Conditions	
Acoustic Noise Level	≤ 73 dBA (at 1.5m height, 1m distance)
Electrical Insulation	> 5 k Ω per platform (at 500 VDC)
Electrical Bonding Continuity	< 1 Ω

3.2. Maintenance Demonstration (MTTR Targets)

The procedure includes a demonstration of key maintenance tasks to ensure they can be completed within the specified Mean Time To Repair (MTTR).

Component Replacement	Number of Personnel	Target MTTR
DCU (Door Control Unit)	1	< 30 minutes
Belt	1	< 30 minutes
PLC (Programmable Logic Controller)	1	< 30 minutes
One Switch at DLCP	1	< 30 minutes
Motor	2	< 30 minutes
ASD (Automatic Sliding Door) Locking Block	2	< 30 minutes
ASD Glass	2	< 30 minutes
ERM (Emergency Release Mechanism) Housing	2	< 30 minutes

4. Notable Directives and Quotes

The following verbatim statements from the Comments Review Sheet highlight critical decisions and requirements.

- **On Remote Monitoring:**
- **On Force Measurement Methodology:**
- **On Life Cycle Test Witnessing:**
- **On Maintenance During Life Cycle Test:**
- **On Subcontractor Approval:**