# Siemens Mobility Pte Ltd:
## Enhancing Efficiency and Reliability through the application of SS IEC 60812 in Rail Systems Projects

## Synopsis

With the consistent expansion of the Singapore railway network, suppliers and manufacturers are exploring new methods to boost their offerings through extensive research and development. This is evident in conjunction with the upcoming development of the Jurong Region Line, RTS Link and Cross Island Line.

Furthermore, with challenges stemming from an aging infrastructure within the existing railway system in Singapore, there is a crucial need for operators to procure reliable, tested and proven components to replace legacy equipment as well as system.

To enhance the reliability of the railway eco-system, the use of Failure Modes, Effects, and Criticality Analysis (**FMECA**) and Failure Modes, Effects and Analysis (**FMEA**) is evident in lowering project risks through identifying potential failure(s) at an early stage.

With the adoption of **SS IEC 60812** (FMEA & FMECA), one such company that embraced this standard is Siemens Mobility Pte Ltd. Siemens Mobility has maintained a continuous involvement in the development of Singapore's MRT network since the 1980s, contributing significantly through various projects, including the provision of second-generation rolling stock.

Siemens Mobility leads the industry and realises sustainable mobility solutions for customers through technology innovations. They have an established presence in Singapore with over 300 staff serving esteemed partners such as the Land Transport Authority, SBS Transit and SMRT.

**"FMECA & FMEA"**

## Siemens Mobility

Siemens Mobility is proud to have delivered iconic land transport projects in Singapore such as the Signalling and Electrification systems for the Downtown Line and appointed to provide rail systems for the upcoming Jurong Region Line, Cross Island Line and the Rapid Transit System (RTS) Link between Johor-Singapore.

**Industry leading products developed:**

- *Trainguard SIRIUS CBTC*
- *Trackguard Westrace MKII*
- *Sicat® SR Overhead Conductor Rail*
- *Sicat® SRD Retractable Overhead Conductor Rail*

# Quality Management through SS IEC 60812

- Siemens Mobility demonstrates its commitment to quality management which includes adopting best practices such as SS IEC 60812 standard application.
- When the equipment and systems from past projects that are similar to those in newer projects, Siemens Mobility **leverages** well-documented Failure Modes, Effects, and Criticality Analysis to **streamline** design process.
- Applying SS IEC 60812 has helped Siemens Mobility meet the requirements of LTA, ensuring that critical failure information and safeguards are duly communicated to customers.

## "Streamline & Leverage"

**BRENDA HO**
**Senior RAMS Engineer**

"At *Siemens Mobility, we view FMECA as a key part in delivering safe and reliable systems.*

*By applying the SS IEC 60812 standard, we have identified potential failure modes early, understood their impact, and took proactive steps to address them.*

*This structured approach not only improves system performance but also enables us build on past experience , resulting in consistent support delivery, enhanced efficiency, and continous improvement of our works."*

# Incorporating SS IEC 60812:2023

## >>> PRODUCTIVITY<<<

To enhance productivity, Siemens Mobility identifies equipment or systems from older projects that are similar to those in newer projects, leverage on well-documented past FMECA to streamline design processes. This comprehensive documentation allows for quick access to information, improve the design quality and significantly reduce time needed for analysing similar systems and subsystems. Furthermore, it has helped the company to meet LTA requirements, allowing critical failure information and safeguards to be duly communicated with the customers.

## >>> INNOVATION<<<

Failure mode analysis methodology in SS IEC 60812:2023 enhances predictive maintenance strategies for Siemens Mobility. This approach allows for proactive intervention and reduces service disruptions. Through this structured framework, the company consistently improve its design, manufacturing, and railway solution maintenance, maintaining its competitive advantage and ensuring industry alignment. By facilitating innovation across product and system levels, Siemens Mobility effectively addresses real-world demands and expands its global reach

## >>> SUSTAINABILITY<<<

By adopting the use of FMECA, Siemens Mobility standardise data to optimise various project areas such as design, materials, and manpower. For instance, having a predecessor's FMECA enables the company to develop new designs or materials that pre-emptively addresses critical effects and failure modes, fostering improved and sustainable designs. When it comes to maintenance, refining the inspection schedules and manpower allocations become possible by focusing on the actual needs of the equipment rather than adhering to a fixed schedule. This approach enhances efficiency and reduces the risk of faults by avoiding unnecessary maintenance, allowing for better-targeted inspection efforts based on FMECA insights.

## >>> INTERNATIONALISATION<<<

Across Siemens Mobility offices, FMECA provides a universal framework that is readily adaptable to diverse regions and markets. By leveraging detailed FMECA, the company can swiftly identify locale-specific challenges and adapt to local requirements and regulations. This systematic approach enhances international collaboration among Siemens Mobility's global offices, facilitating the worldwide implementation of innovative solutions and thereby strengthening the company’s influence in global markets. Furthermore, by integrating system-level solutions, such as those in Singapore, with products developed across its global offices, Siemens Mobility drives international cooperation and operational synergy. This ensures the delivery of consistently high-quality solutions to its customers.

# Applying FMECA in the Development of Sicat® SR

## Sicat® SR Overhead Conductor Rail

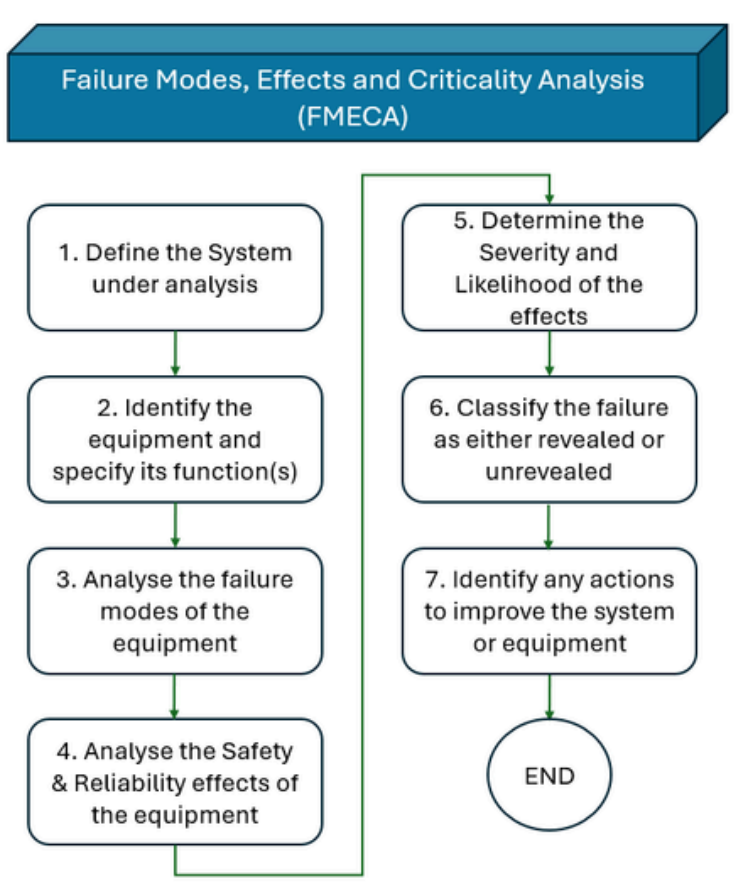
The Sicat® SR is an aluminum overhead conductor rail ideal for use in tunnels, under bridges or maintenance workshops. It supports traction power from 750 to 3000 V DC and 15 to 25 kV AC, and can handle train speeds up to 250 km/h.

The system features an aluminum rail with a clamped contact wire for current transmission to the rail vehicle. It contains components for structural support, electrical protection, and thermal expansion management.

By applying FMECA process to the Sicat® SR Overhead Conductor Rail, critical components such as the conductor rail, insulators, support brackets, and pantograph interface were analysed. This helped identify and prioritize risks, guiding maintenance and design improvements to ensure safe and reliable operation.

## FMECA

- The process begins by defining the system and its boundaries, followed by identifying possible failure modes for each piece of equipment.
- Each failure's impact is assessed, with severity and likelihood ratings assigned.
- The criticality of each failure is also evaluated to determine whether it can be detected before causing adverse consequences.
- Lastly, risk controls are identified to improve the system and equipment.
- The diagram (right) provides a flowchart of the key steps involved in the FMECA process.




[1] A full copy of the SS IEC 60812:2023 can be purchased via www.singaporestandardeshop.sg.
[2] For more information on how you can contribute to standards development, visit: https://www.enterprisesg.gov.sg/grow-your- business/boost-capabilities/quality-and standards/participate-in-standards-development.