Training on Railway RAMS & EN Standards (50126, 128 and 129)

Introduction

Reliability, Availability, Maintainability and Safety (RAMS) plays an important role during design/operation of Railway systems. Safety and Availability are two visible outcome of RAMS Activities. Availability is primarily concern with performance of Railway systems/subsystems and is one of the most important KPI of Project during the operation. Safety is the obligatory requirement of every railway project and needs to be ensured in all aspects of the project/product development and through the project lifecycle. Safety requirements vary project to project and decided by safety/regulatory authority of the project/product.

RAMS needs to be assured for all subsystems in all life cycle phases, e.g., design, implementation, operation, and maintenance. The overall RAM target needs to be specified in the RAM plan in terms of punctuality and delay tolerance. Similarly, the safety target needs to be specified in the Safety plan. These targets are then to be apportioned to different subsystems of railway systems such as Rolling stock, Signalling, Power supply systems, Track works etc. Once RAMS targets are allocated to each Railway systems, it shall be further apportioned to its subsystems and so on. Once RAMS requirements have been specified; RAM and Safety Analysis shall be carried to achieve this target progressively.

This course aims to introduce the basic concept of Reliability and safety; associated engineering principles, methods, and tools for deciding on RAM and Safety targets. Course also covers various RAM and Safety Analysis techniques/calculation. These techniques/calculations are guided by three key RAMS standards for EN 50126, EN 50128 and EN 50129, which will be also covered during the course.

Intended Participants

As adherence to RAMS is to be ensured by all subsystems and in all phases of the project, this course will be useful for all personnel involved in design and implementation of the project. This will be of particular interest for those, involved in specifying the design requirements and monitoring the design of all subsystems. It goes without saying that this will be of special benefit for the personnel responsible for RAM and Safety of the project. All the participants should ideally have a technical background.

Benefits of attending the course

The key take-away from the course is, the participants will understand the process of specifying/demonstration the RAM and Safety requirements/targets. Participants will get familiarized with process/techniques for RAM and safety analysis such as RBD, FTA/FMECA, PHA, SHA, IHA, O&SHA, etc. Also, the participant will be able to produce RAMS documents for the project.

Training Contents

Training will be conducted in 12 sessions each of 1 hour 30 minutes. Session scheduling will be slightly changed if required. Details of the session contents is provided below:

Session 1	**Introduction to System Assurance and RAMS** • Basic concept of System Assurance and its associated activities. • Relationship between System Assurance and RAMS activities. • RAMS Management: What, Why and How? • RAMS Management: Issues and challenges to Railway Project • Brief on RAMS standards to Railway Applications
Session 2	**Reliability Mathematics and RAMS Parameters** • Probability & Statistics Basics for RAMS • Introduction to RAMS Parameters and associated calculations
Session 3	**Reliability Prediction** Reliability Prediction and MIL-217F
Session 4	**System Reliability Modelling** • RBD, Series, Parallel and other complex configurations
Session 6	**Basics of Safety Engineering (Functional Safety)** • Basic concept of Safety in the context of Metro/Railways. • Hazard and Risk • Risk Matrix and Risk Acceptance Principles • Safety Management (PHA/SHA/IHA/O&SHA) & Hazard Log • SIL concept
Session 5	**Risk Modeling** • Fault Tree Analysis (Reliability & Safety) • Failure Mode Effects & Criticality Analysis (for Reliability and Safety)
Session 7	**CENELEC-50126-1** • Overview, Scope, and Structure of EN 50126-1 • Railway RAMS; RAMS Target: Availability & Safety • RAMS Elements and Factors Affecting RAMS • Management of Railway RAMS and RAMS Lifecycle
Session 8	**CENELEC-50128** • Overview, Scope, and Structure of EN 50128 • Concept of S/W safety integrity levels • Software management and organisation • Software assurance and Generic software development • Development of application data or algorithms • Software deployment and maintenance
Session 9	**CENELEC-50129** • Overview, Scope, and Structure of EN 50129 • Requirements for developing safety-related electronic systems • Requirements for elements following different life cycles • The Safety Case- structure and content • System safety acceptance and subsequent phases
Session 10	**RAMS Documentations: Content list of RAM & Safety documents** • RAM Plan; RAM Analysis, RAM Demonstration • Safety Plan; Safety Analysis (PHA, SHA, IHA, & OSHA); Hazard Log; Safety Case
Session 12	• Recap, Discussions and Feedback (30 Mins) • Assessment (60 Mins)

Trainer

Dr. VNA Naikan, Professor, IIT Kharagpur, India
Dr. N. K. Goyal, Associate Professor, IIT Kharagpur, India
Dr. Ajeet Kumar, Ph.D. (Reliability Engineering)- IIT Kharagpur, India

Brief Introduction of Trainers

Dr. V.N.A. Naikan is currently Professor and ex-Head of Subir Chowdhury School of Quality and Reliability (earlier known as Reliability Engineering Centre) IIT Kharagpur, WB India. He did his MTech. and Ph.D. degrees from this school. He graduated in mechanical engineering with second rank from the University of Kerala. He also worked with ISRO, Chinese University of Hong Kong, IIM Ahmedabad and Union Carbide India Limited in various capacities. He has published more than 100 research papers in international journals and conferences, a book on Reliability Engineering and Life Testing and a chapter on SPC in the Handbook on Performability Engineering. He is advisory and editorial board member of several other journals. He is Fellow of Institution of Engineers, and member of professional societies including, IEEE, IEI, SREI, System society of India, etc. He has been doing consultancy and research projects for organizations like ISRO, BARC, BHEL, Defence Forces, and Ministry of Textiles. He is also a visiting professor at CALCE, University of Maryland, USA.

Dr. Neeraj Kumar Goyal is Associate Professor at Subir Chowdhury School of Quality and Reliability (earlier known as Reliability Engineering Centre) IIT Kharagpur, WB India. He has received his PhD from IIT Kharagpur in Reliability Engineering in year 2006. He received the Bachelor of Engineering (HONS) degree in Electronics and Communications Engineering from MREC Jaipur, Rajasthan, India in 2000. He has served as an Executive in M/s Secure Meters Ltd., Udaipur from July 2000 to July 2001. He has been serving IIT Kharagpur as faculty member since 2006. He is actively engaged in providing research services to Indian railways, national defense, electricity board and nuclear power organizations in the area of reliability and safety engineering. He is referee to a number of international journals publishing in the area of RAMS.

Dr. Ajeet Kumar did his M. Tech (Computer Science) from MNNIT, Allahabad (India) and Ph.D. (Reliability Engineering) from IIT Kharagpur (India). He is having more than 20 years of experience in System Assurance and RAMS, wrapped up with cross-functional domain knowledge of on Metro & Rail industries. Having hands-on experience on System Assurance & RAMS, has contributed various Metro Rail projects such as Rail Project Victoria (Australia); High-Speed 2 (UK); ElectroLogIXS (UK); Broadway Subway (Canada); QNGR-ETCS (Australia); RRTS/MRTS New Delhi (India); R151 Singapore (Singapore); Etihad Rail (UAE); Dubai Metro Extension (UAE); Dubai Expo link 2020 (UAE); R2P (Germany); WDFCC (STP-17) (India); LR3 Kualalumpur (Malaysia); Jakarta LRT & MRT (Indonesia); Network Rail (UK); Delhi Metro Line-8 (India); Doha Metro Project (Qatar); Sydney Metro (Australia); Hyderabad Metro (India); Invensys Rail (USA and UK).