Training - Table of Contents

RAMS CENELEC standards EN 50126-EN 50128-EN 50129
Training cycle

The training cycle is made out of 4 parts :

Part 1

INTRODUCTION

- **Why this training ?**
- **Introduction of participants**
  - Your expectations on the training
  - Your experience on RAMS-LCC
  - Introductory questions and exercise

1. Conceptual description RAMS-LCC: WHY ?

1.1. Generalities / definitions : WHAT IS IT **?**

General presentation of the concepts : Reliability, Maintainability, Availability, Safety, LCC : what is the interrelation between these parameters

1.2. Objectives of RAMS-LCC : WHAT DOES IT MEAN TO CITIZEN/CUSTOMERS ?

(Overall context according to EN 50126)

1.2.1. **Safety** :
- Protect people and assets : demonstration towards citizens/authorities => demonstration / evaluation / authorisation
- Preventive approach : factoring in Safety in the projects

1.2.2. **Economic efficiency**: save money

1.2.3. **Quality of service** : guarantee passengers satisfaction (CEN 13816)

2. Legal Obligations : **TO WHOM ARE WE ACCOUNTABLE ?**

Reminder : difference btw Laws and standards

2.1. SAFETY (legal) :
- Safety Directive 2016/798 => CSI lagging et leading
- CSM : Operations vs Projects (change)
- TSI : Technical Specification for Interoperability
- Belgian Spoorcodex : Royal decrees

2.2. LCC : Belgian law of 17 June 2016 (marchés publics/overheidsopdrachten)

3. Standards : **WHAT ARE THE TOOLS ?**
- GENERAL standards : IEC 60300-3; IEC 61508; Maintenance
- Railway SAFETY Standards: CENELEC EN 50126, 50128, 50129
- QUALITY / Project Management: ISO 9001 / IRIS - ISO/TS 22163; PMBOK; ISO 1702x for Inspectors

Part 2

4. Managing RAMS: WHO DOES WHAT WHEN ?

4.1. Main activities: Specify, Realize, Demonstrate, Evaluate, Accept/Authorize

4.2. Organisation of RAMS during the project life cycle : V cycle / Phases according the EN 50126 - integration of RAMS-LCC in projects

4.3. Structure of Safety Cases / Validation of Safety Documents

4.4. Supply chain management for RAMS-LCC :

4.4.1. Quality for RAMS

4.4.2. Distribution of tasks

4.4.3. Manage RAMS with suppliers : specification and control

4.5. Roles for Safety: the pyramide of trust => Railway Undertaking/Infrastructure Manager, Manufacturer, ISA, DeBo, NoBo, AsBo, NSA, Belac

5. RAMS Parameters: HOW TO MEASURE/QUANTIFY ?
- **5.1.** Parameters for Reliability
- **5.2.** Parameters for Availability
- **5.3.** Parameters for Maintainability
- **5.4.** Parameters for Safety

6. Factors that influence RAMS : HOW TO INFLUENCE RAMS ?
- **6.1.** **EN 50126** mapping
- **6.2.** Responsibilities within the supply chain / What do we need to control

7. Manage reliability : HOW TO ACHIEVE BETTER RELIABILITY ?
- **7.1.** Prerequisites
- **7.2.** 3 main approaches to predict reliability
- **7.3.** Mathematical Models : Constant Failure Rate vs Weibull
- **7.4.** Reliability of systems
- **7.5.** Design for reliability

8. (Maintenance strategies LCC: HOW MUCH TO INVEST IN MAINTENANCE vs RELIABILITY)

Slides of Chapter 8. Are provided for information, but this chapter is not part of the oral training

Part 3

9. Safety – Generalities : WHAT IS THE MEANING OF SAFETY ?
- **9.1.** Reminder : Applicable standards
- **9.2.** General definitions
- **9.3.** Failure vs Hazard vs Incident vs Accident
- **9.4.** Notion of unfolding of events: FTA, Bow-tie diagram
- **9.5.** Safety Integrity : SIL and THR

10. Setting up Objectives (political level): acceptance criteria/risk appetite (ALARP, MEM, GAME); global THR; Lagging vs Leading indicators: **WHAT DO WE NEED TO ACHIEVE ?**

11. RISK Management for Safety : HOW TO MANAGE SAFETY RELATED RISKS ?

=> Risk Management to achieve Safety : **CSM 402/2013 and EN 50126**
- **11.1.** Identification: REX, FMECA, etc.
- **11.2.** Analysis
- **11.3.** Evaluation: setting criteria / matrix
- **11.4.** Treatment: risk reduction

Part 4

12. Determination of SIL levels : HOW TO SPECIFICY SAFETY INTEGRITY ?
- **12.1.** Example from EBA
- **12.2.** Safety of systems

13. Content of the Safety Case according to EN 50129: HOW TO STRUCTURE THE DEMONSTRATION ?

14. Software Safety according to EN 50128:2011: HOW TO MANAGE SAFETY OF SOFTWARE ?
- **14.1.** Generalities
  - Context : respective scopes of the EN 5012x standards
  - Types of requirements and Principles
  - Software Safety Integrity Level : SSIL
  - General « project sequence » of the EN 5012x
- **14.2.** Software Assurance, Managing Software tools
- **14.3.** Software development lifecycle / documentation
- **14.4.** Human factors: Organisation, roles and responsibilities, Independence, Documents Control

Closing discussion / Questions

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