Reliability of railway operations during and after ERTMS migration

Problem description

The railways in the Netherlands face the challenge to migrate towards the radio-based signalling standard ERTMS (European Rail Traffic Management System) that will increase safety, capacity and interoperability of international railway traffic. The migration towards ERTMS will have a big impact on operational processes and procedures for users such as train drivers and dispatchers. This will also introduce risks to the reliability of the integrated railway transport system with new interactions between technology, processes and people. A main research question is therefore how to analyze and mitigate these risks to build confidence that the railway system remains safe and reliable during and after the migration to ERTMS.

Objectives and Assignment

The aim of this project is to develop a Systems Theoretic Process Analysis (STPA) to analyse reliability risks of the integrated railway transport system due to migration to ERTMS. STPA assumes that a system consists of functional hierarchical components where reliability is an emergent property of the behaviour and interactions of components. Examples of components are the Train Operating Company, train driver, train, and ERTMS driver-machine interface. Unreliability is caused by unsafe control actions due to inadequate feedback control loops.

The assignment consists of the following steps:

- Literature review on STPA applied to railways and related systems
- Analysing the changes in the developed user processes for drivers and dispatchers
- Building a hierarchical control structure of functional components and interactions
- Identifying unsafe control actions and scenarios that will lead to unreliability
- Deriving system-level constraints to guarantee system reliability.

Candidate background

Knowledge of railways and transport safety, such as from the courses Railway Operations and Control (CIE5826) and Transport Safety (TPM004A). Dutch language is preferred since Dutch documentation of user processes must be studied.

External support

This project is carried out within the ERTMS Programme organization with close cooperation of ProRail and NS.

Information

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