



# Safety Layers at Level Crossings

Dipl.-Math. Stefanie Schwartz, Dipl.-Ing. Markus Pelz

## Increasing Safety at LX

Increasing safety at level crossings (LX) is one of the great challenges of these days. To do this it is necessary to identify the weaknesses of the LX system. The LX is considered to be protected by several safety layers. Every weakness is a gap in one of these safety layers. This is illustrated by the Swiss Cheese Model.

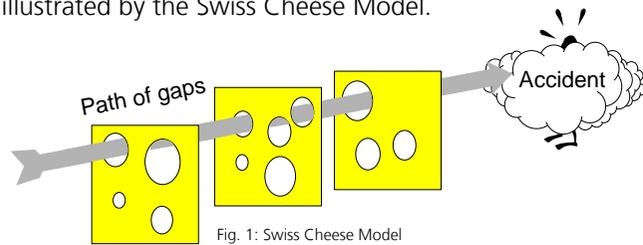
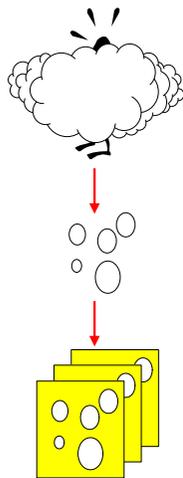


Fig. 1: Swiss Cheese Model

## Why-Because Analysis (WBA)

WBA allows a structured accident analysis. At the DLR, this method has been used to analyse several LX accidents. WBA identifies gaps in the safety layers. The knowledge about these gaps can be turned into a model of safety layers called MoSiS. MoSiS is currently being developed at the DLR and is expected to become a useful tool in increasing safety at LX.



## Accident at LX

In September 2005 a regional express train collided with a garbage truck at a level crossing in Germany. The trailer truck entered the level crossing from a parking place where it was loaded. This meant the truck driver had to follow a tight right hand bend.

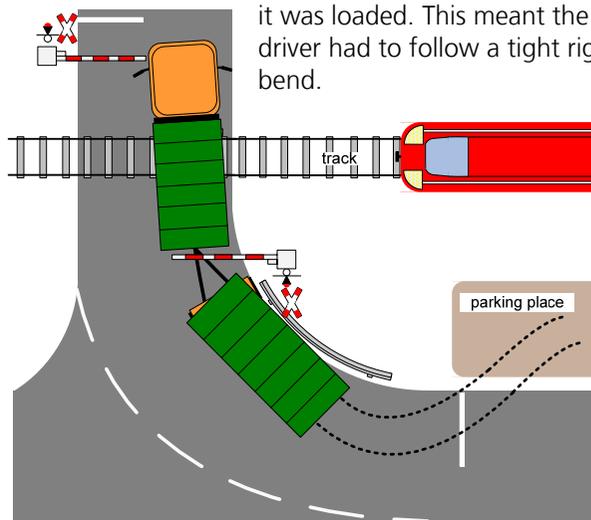


Fig. 2: Accident at LX

To avoid contact with the beam barrier the truck driver started shunting on the LX. In the meantime the train passed the rail contact that activated the LX. The half barriers closed, one of them right between truck and trailer. The truck driver didn't recognise the approaching train until he saw the closing barriers. He panicked, jumped out of his cab and left the truck on the rails.

## Accident Analysis

The Why-Because Analysis of the accident revealed gaps in the safety layers of the LX. The path of gaps can be interrupted by closing at least one of the gaps or by introducing a new safety layer.

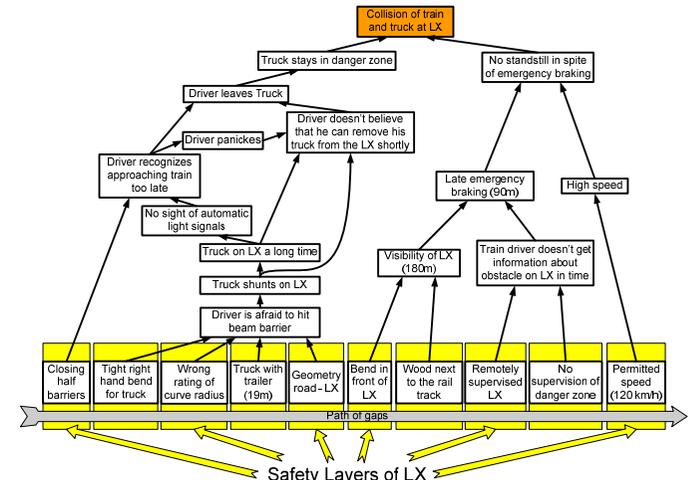


Fig. 3: Why-Because Analysis of accident with safety layers

## Outlook

MoSiS will include causes from all analysed LX accidents. It will show the gaps in the safety concept of a system and help closing these gaps efficiently. Closing a gap means preventing the accident from happening again. Thereby MoSiS will help to increase the safety at level crossings.