Analysis and modelling of railway accidents

Railway transportation is regarded as one of the most secure means of transport. However, it still happens nowadays that trains collide with other trains or with individual traffic at level crossings. These accidents need to be prevented. Together with the industry partner ENOTRAC, an existing physical model for forecasting the extent of damages (deaths, serious injuries, casualties in the train) is further developed and validated. This model supports the establishment of risk analysis for the authorization of railway vehicles and railway operation. However, if all preventions have failed, it is vital to determine the root cause of the accident. Only in this case it is possible to experience a learning effect and also to prevent future accidents. The accident examination method CAST provides a new way to evaluate the root causes. In this thesis, the method CAST will be tested on its suitability for analysing train accidents. ENOTRAC’s existing model for collisions at level crossings is improved and validated by statistical evaluations and the application for real accidents. Thanks to using this validated model it is possible to estimate the measures of damages for train collisions with road vehicles in the given categories of extend. In addition, the model is applied to a collision between two trains.

The system oriented accident analysis method “CAST” is evaluated to determine if this method is more suited than conventional accident analysis methods to detect root causes of accidents in railway traffic. The method aims to describe all parameters relevant to an accident and also helps to identify systematic errors in the said process. The method is being tested on a real accident and the results are compared with an existing examination report. In this way, new additional causes of accidents could be detected.

The advanced model ENOTRAC can be used to estimate the extent of damage for collisions at level crossings. However, for collisions between two trains the model in its current state of research can only provide a rough framework for the measures of damage. The accident analysis method “CAST” is advantageous as it provides the opportunity not only to detect causes, which are directly connected to the accident, but also root causes with an indirect relationship to the accident.