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## **Cost Analysis of Complex Technical Systems**

Thesis project within FutuRe: European Program on Future Railroad Systems

### ***Background***

Level crossings are a dangerous part of railways, causing several deaths every year. While the safest solution is to remove level crossings altogether in favor of bridges and tunnels, this is complicated and so expensive that it cannot be done on a large scale. In Europe, many of the existing level crossings are equipped with old and partly outdated technical systems.

In Sweden, the Traffic Administration has an ongoing program to update all its 6,500 level crossings with a new, state-of-the-art protective system, called ALEX (automatic level crossing system). However, it has been found that ALEX is an expensive and inflexible. Consequently, there are ideas to develop an alternative, modular solution, which should be scalable, possible to tailor to local needs, but also compatible with legacy assets of existing systems. However, railway security and signaling systems are highly complex and it is unclear how such an alternative solution would impact the costs for a complete upgrading an existing railway line.

### ***Purpose***

To study how a modular level crossing protection system would impact the costs for upgrading an existing regional line.

The aim is to identify and analyze possible cost elements to be able to define issues for future research.

### ***Research Design***

The idea is to study 2-4 scenarios of upgrading, e.g., one unprotective and one protective level crossing, in combination with one high-end and one low-end modular solution.

The project is explorative and requires analytical and social skills. It will be based on qualitative data from interviews as well as studies av written material.

### ***Organization***

The project is carried out within the context of FutuRe, a European program on future railroad systems, which involves actors, such as, Alstom, RISE, KTH, and the Swedish Traffic Administration (Trafikverket).

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