

PhD Project: The analysis of information flows as a way to improve the level of resilience of the planning system

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Background:

Resilience is the ability to keep, or recover quickly, to a stable state, allowing it to continue operations during and after a major mishap or in the presence of continuous significant stresses.

Wreathall, J. (2006). *Properties of resilient organizations: An initial view*. In Hollnagel, E., Woods, D.D., Leveson, N. *Resilience Engineering – Concepts and Precepts*. (pp 275 – 285) Aldershot, UK: Ashgate

On a daily basis, the potential for resilience in the system arises from the way its members trade-off between safety and performance. Overall, the way in which people are able to balance their trade-offs in accordance to the specific constraints and pressures of arising changes in the operation environment will determine the level of resilience the system is capable of achieving and maintaining.



The rail industry has faced considerable evolution in recent years. A need for sustainable transport solutions is contributing to a higher political and public focus on rail transportation throughout Europe. Within the UK rail industry, engineering is facing a remarkable challenge to deliver, not only higher volumes of maintenance work as a response to a more intensive use of rail infrastructure, but also, enhancement projects capable of satisfying demands for a higher capacity of rail transportation.

Investments on higher output technologies are foreseen. However, if increasing volumes of work are to be delivered within shorter access opportunities, more efficient and reliable planning processes are required. The focus of an ongoing research is to improve the ability of the engineering work system to respond to its current challenges by identifying opportunities to incorporate resilience engineering concepts and approaches.

Novel Aspects:

The following aspects can be considered innovative:

- The fact that this research aims for the enhancement of resilience represents a new approach to the improvement of safety and the overall performance of the system.
- The proposed analysis methodology focuses on the system and its performance as a whole, as opposed to a more “static” and descriptive survey of its components. To a certain extent, this is supported by new concepts and methods such as FRAM¹ (Functional Resonance Analysis Method), which also introduces new views within the rail industry.

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Progress:

A study of all factors contributing to resilience would be unfeasible within the scope of this project. Given that the system under analysis is mostly based on the production and distribution of detailed information (in the form of a work plan) to support engineering work delivery, the analysis of information flows within the system was considered a viable steer for this research.

The following methodological steps are being considered:

- Interviews with planning experts at different levels of the process and from different areas of the country. This not only supports arguments towards the use of resilience concepts within rail engineering but it also serves as a basis for the development of a more in-depth analysis of the planning system.
- Observational methods applied to planning meetings, during which critical planning decisions are made regarding the allocation of access time, resources and the actual work delivery. The goal is to understand planning decisions, based on the register of information items and sources that are used as an input, as well as the characterisation of the type of data that is produced at meetings. In order to systemise observations, these will focus on the chairman of each meeting, which according to the process mapping, has the responsibility of ensuring the required decisions are made and delivered.
- Follow up on a given number of work assets as they go from earlier stages of planning down to the detailed worksite planning. Depending on its feasibility, the possibility of following these through to the actual work delivery (“day of the race”) is being considered as a way to relate the track work performance with the “quality” of planning.
- Retrospective analysis of planning processes using planning meetings logs, safety data and other archival sources. The goal is to develop a hindsight understanding of the planning “quality” starting from work delivery performance.
- Use of FRAM¹ to describe the planning in terms of functions and map the planning requirements regardless of the processes in place. This can later on, support the development of guidelines or recommendations that may be valid not only for today’s circumstances, but also for future planning processes that may arise.

¹Dechy, N., Cojazzi, G. (2007). Proceedings of the 33rd ESReDA Seminar (European Safety, Reliability & Data Association). Ispra, Italy: European Commission.

The analysis of interviews with experts is currently underway. These were conducted as semi-structured meetings and sound recorded.

Although the engineering of resilience into a system of such high complexity is likely to require a broader approach to different areas and characteristics of the process, it is expected that the subject under analysis (information flows) will provide an initial understanding of the potential for resilience and the identification of other significant areas of research towards this end.