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Control Room Design and Integrated Operations
Experiences from some industries

Summary
This report was commissioned by the Norwegian National Rail Administration (Jernbaneverket). It summarizes an internal seminar arranged on the 21st – 22nd August 2016 "Control Room Design and Integrated Operations". In addition, it also briefly describes relevant experiences from other actors and industries. Some recommendations are addressed regarding future needs and challenges connected to the establishment of future traffic control centres at the Norwegian National Rail Administration.

Digitalization is a global challenge affecting a variety of social conditions, work processes and businesses. Today's changes in technological development can be termed as "the fourth industrial revolution". Beyond including advanced technological innovations and products, digital development most likely has radical impact on interaction, communication and work practices. In addition to changing products and services in businesses and the labour market, digitalization will also create new business models in many industries. To the National Rail Administration, the digital change involves amongst other acquisition of a new signal system (ERTMS) for the entire Norwegian railway network and a new national Traffic Management System (TMS). As a part of this, an assessment of design and ergonomics of future traffic management control centres should be included when the centres are planned and built.

The aim of this report is to shed light on key challenges and opportunities when introducing new control rooms at the traffic control centres in the National Rail Administration, in addition to pinpointing related R&D needs.

The first chapter describes the background for the report and outlines challenges for a new national Traffic Management System (TMS). The chapter describes several aspects that should be considered when new control rooms are assessed, planned and built. Key problems addressed in the report are:

1) Identification of new and existing functions and associated requirements that must be fulfilled (operation of central, redundancy, training and simulation, technical support offices and meeting rooms, tours etc.)

2) Identification of new work processes that are important for interaction both externally (other operations centres, train drivers, technical experts) and internally (teamwork, dispatching, maintenance and repairs, digital documents), as well as increased automation

3) Mapping and assessment of requirements for the design of control rooms with accompanying facilities

4) Mapping and assessment of need for competence, education and training

The second chapter provides a summary of the seminar "Control Room Design and Integrated Operations". The National Rail Administration and SINTEF cooperated in planning and conducting the seminar. The seminar included visits to the Norwegian Public Road Administration (Traffic Management Centre in Bjørvika, Norway) and to...
Banedanmark (Traffic Tower East in Copenhagen, Denmark). Further, the seminar included lectures (see attachment C in the report), and reflections in plenum and in groups.

The presentations from other Norwegian transport modalities as sea, road and air indicate a number of similarities and common challenges both with the railway and between the transport modalities. Digitalization and new technology provide many opportunities for and challenges of surveillance, controlling and managing traffic. All transport modalities consider centralization, i.e. a national traffic management in addition to the need for regional existence. Other themes that several participants mentioned are e.g. how to deal with anomalies, emergency preparedness, design and ergonomics of control rooms, traffic management, development of new ways of working and collaborating, in addition to the need for competence and education programmes.

Chapter 3 gives a brief and supplementary description of practices in other industries and sectors that can address future challenges related to railway traffic management centres, e.g. management and control, automation and remote control. The report describes practices for transport modalities in Norway such as air, sea and road, and other sectors such as drilling and production of petroleum, as well as management and control of gas transportation to Europe.

The last chapter points out some knowledge requirements for the design of new control centres and related ways of working at the National Rail Administration. These recommendations should be considered in the context of general digitalization, automation and trends in society. There are knowledge needs related to subjects such as:

1. The traffic control centre. Work practices and design of the centre itself.
2. Organization of control room and related activities within the company. Number of traffic management centres, and the consequences of potential changes.
3. Railway traffic management in the future. In addition to current management, control and monitoring, this topic covers identification of future work practices.
4. The digital railway. How implementation of new and advanced technology will affect the society in general and the railroad in particular.

Finally, this report points out relevant research topics both in general, and to the TMS project in particular. General R&D themes supporting decision making in the TMS project are:

- Quality and safety in traffic management practices
- Efficiency of traffic management
- Flexibility in new traffic management services and ways of working
- Attractive work environment and working tasks

Proposed R&D issues particularly related to layout and design of future traffic management centres are e.g.: Functions and flexibility, roles and responsibilities, distributed collaboration, the digital operator, automation and remote control, safety, cybersecurity, in addition to developing a program for competence development, education and training.

One of the recommendations regarding research methods is that the TMS project should consider using an action research approach. This approach will result in proposal of concrete actions and measures in the course of development towards final decisions. The National Rail Administration should consider performing comparative studies and collaboration with other sectors nationally and internationally. In addition, SINTEF recommends that implementation and innovation are to be based on international standards for design and ergonomics, and to involve external experts and potential users. Relevant themes especially for the TMS project are e.g.:

- Co-localisation of primary and secondary functions
- Flexibility in dealing with technical equipment and work processes
- Competence and education of control centre staff
- Distributed cooperation
- Ergonomics and design of the control centre
- Digitalization and the choice of flexible solutions for technology and design
- Development of best practice work processes
- Attractive work environment