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Common-basis safety management system for railway infrastructure managers

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ABSTRACT

In Denmark, in order to have a safety approval for a railway infrastructure it is required to have established and implemented a safety management system, according to the Danish legislation (BEK712) as well as the European regulation 2018/762.

The infrastructure manager must, in order to gain and maintain the safety approval, show the Danish National Safety Authority (NSA) that the SMS is compliant with the applicable requirements. The regulations, and the NSA, therefor do not edict how the SMS shall be constructed, but the NSA only decide if the individual infrastructure manager is compliant. This means that there is not a common-basis for construction of SMS', but it is up to the individual infrastructure manager to develop and construct a suitable SMS.

While there are specific requirements related to the different types of rail systems, there is the potential to develop a common-basis that can be scaled to different types of infrastructure manager.

This project investigates the possibility to develop a common-basis for constructing a SMS for railway infrastructure managers. The project maps the requirements related to SMS for different types of infrastructure managers, as well as investigate best case approaches in Denmark. Based on this the project develops a draft blueprint framework for a common approach for SMS' that includes tools for ensuring adaptive use.

The project shows that a common-basis is partly possible but must be differentiated based on the size, activities and needs of the organization. To ensure that several different approaches are not necessary, it is proposed to develop a draft blueprint based on activities and associated risks. Furthermore, it is proposed to differentiate the tools used in the SMS functions, e.g. competency management, training, monitoring, etc., to ensure that the simplest solution is chosen based on the size of the infrastructure manager. Last, it is proposed that the SMS is a digital system which a web- an/or portal-based setup, where the user interface can be build according to the end-user preference, but to also give the option of paper-based functions.

Keywords: Safety management system, infrastructure manager, railway, safety approval.

PREFACE

This master thesis is completed during the 4th and final semester of the "Master of Science in Technology in Risk and Safety Management" programme at Aalborg University Esbjerg, Denmark. The frame of this master thesis is specified under the "Master thesis" curriculum.

The project focuses on developing a common-basis for managing regulative requirements for infrastructure managers in Denmark.

Acronyms used in this paper can be found in the section Acronyms together with an explanation of its meaning.

Main chapters, sub-chapters and figures are numbered continuously to its corresponding chapter.

References used in this project can be found in the section Bibliography and uses the American Phycological Standard (APA); (author, year). References to other sections in the project are underlined; example. By clicking the underlined word, the reader will be directed to the corresponding section.

The author would like to thank the Rail Safety department at Rambøll Denmark A/S as well as Anders Daniel Møller from Keolis, Christian S.M. Olsen from Lokaltog A/S and Nicola de Negri from Metro Service for contributing time, effort and knowledge to this project.

About the author

Kirstine Rauschenberg Rejmers Boch has graduated with a bachelor's degree in *"Disaster and Risk Management"* from PH Metropol Copenhagen, Denmark. Kirstine has worked with risk management of railway infrastructure since 2017 on both conventional rail, light rail and metro, and currently holds a position as a specialist in common safety methods of railway applications (CSM-RA) in the Transport division at Rambøll Denmark A/S.

Date: Friday, 10th of June 2022

Signature: 

Kirstine Rauschenberg Rejmers Boch

Acronyms

Some acronyms/abbreviations are inherently Danish and therefore the acronym/abbreviation will be used in the Danish version. An English translation will be given in cursive after the definition – example; "definition (*English translation*)".

Acronym/abbreviation	**Definition**
AAL	Aarhus Letbane (*Aarhus Light Rail*)
BDK	Banedanmark (*Rail Net Denmark*)
BEK	Bekendtgørelse (*executive order*)
CSM-RA	Common Safety Methods of Railway Applications
ERA	European Union Agency for Railways
IM	Infrastructure manager
MS	Metro Service
NSA	National Safety Authority
OL	Odense Letbane (*Odense Light Rail*)
SMS	Safety Management System
QMS	Quality Management System

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1 INTRODUCTION

The concept of railways are an old invention, which has been used in different versions since, at the latest, 1515 with the establishment of the Reisszug in Hohensalzburg, Austria (Teknologihistorie, 2022).

The early railways had wooden rails and horse-drawn wagons (ibid.), which were mainly used for the transport of goods and in mines. This solution was relatively safe, meaning that the technology did not in itself manifest in serious or extensive accidents. This changed when the steam engine was developed into functional steam-powered locomotives in the early 1800s (Lindahall, 2022). The steam-powered locomotive, including the permanent way on which it operated, introduced many risks related to but not excluding the specific technology, the added complexity of the system as well as the higher speed and the introduction of operating with passengers. This meant that where a derailment previously would be expected to have a limited consequence of death/injury and/or material damages, the potential consequences became much greater – not only in terms of the accidents itself, but also in relation to the potential amount of people who could be exposed to the accident.

Denmark's first railway between Copenhagen and Roskilde was opened in 1847 and the first serious railway accident that included passengers, the Gentofte accident, occurred in 1897, when the locomotive driver overlooked a stop signal and collided with a passenger train, resulting in approximately 40 killed and 100 injured (Christensen, 2015). More, less serious, accidents had occurred on the Danish railways before, but this was considered the first accident with many serious injuries and deaths (ibid.).

Considering the potential for worker and public accidents, national executive orders and legislation were passed to promote safety. This lead to the early beginning of safety management systems (SMS) being developed and was further developed based on a learning from previous failures (Arpansa, 2022).

The modern-day Danish safety management system therefore comprise of legal requirements as well as methods for working with risk (Trafikstyrelsen, 2022). The legal requirements are both Danish and European, since the Railway Safety Directive (2004/49/EC, later amended in 2008/110/EC and creation of the European Railway Agency (ERA) ensured harmonised safety principles and procedures across Europe.

In order to operate a railway infrastructure, a safety approval must be gained for the infrastructure. To gain the safety approval is it required to have established and implemented a SMS. The infrastructure manager must, in order to gain and maintain the safety approval, show the Danish National Safety Authority (NSA) that the SMS is compliant with the applicable requirements. The regulations, and the NSA, therefor do not edict how the SMS shall be constructed, but the NSA only decide if the individual infrastructure manager is compliant. This means that there is not a common-basis for the construction of SMS', but it is up to the individual infrastructure manager to develop and construct a suitable SMS.

Whether the infrastructure is light rail transit, like trams and light rails, or mass rapid transit, like heavy rail or metro systems, there are universal requirements for the function of a SMS related to evidence of compliance to regulations, training/competencies, management of changes as well as general maintenance. This means that, while there are specific requirements related to the different types of rail systems, there is the potential to develop a common-basis than can be scaled to different types of infrastructure managers.

1.1 Need for the study

Historically there are several infrastructure managers of differing size in Denmark, but with the addition of Metro and light rails, the amount of different actors are rising. In 2017 Aarhus Letbane started operating with a new SMS, in 2022 Odense Letbane will start operation with a new SMS and in 2025 Hovedstadens Letbane will start operation. In addition, it has not been concluded if Femern Bælt will need a new SMS, or it will be managed with an existing infrastructure manager SMS.

While the market for new infrastructure managers is not infinite, the existence of universal requirements still have the potential to limit the need for local solutions by standardizing the approach in the extent possible.

1.2 Current research

Several management system approaches are widely available today, but especially the ISO models are consistently used for easy recreation of cyclic steps:

- ISO45001:2018 manages occupational health and safety

- ISO 9001:2015 manages quality management systems
- ISO7IEC27001:2013 guidelines management of information technology
- ISO31000:2018 guidelines risk management
- ISO19011:2018 manages guidelines for auditing management systems

However no ISO holistic standard for rail safety management systems has been identified.

In the rail industry, the focus is on managing changes or construction in terms (EN/DS50126, EN/DS5029, CSM-RA). While ERA has developed the CSM-approach to be able to have a broader use through developing the CSM to be able to handle further topics like supervision, safety targets and conformity, the approach has yet to obtain the NSA approval for the individual SMS based on an individual development.

1.3 Scope

The scope of this project is to consider and develop a draft blueprint common-basis than can be scaled to different types of infrastructure managers. The project does not centre around specific types of railways but focuses on the basic requirements – see also Limitations.

1.3.1 Limitations

The following limitations were identified for the project:

i. Only Danish infrastructure managers are in scope. Based on the harmonisation required by ERA, European requirements are considered applicable for Danish infrastructure managers but are managed through implementation of European directives into Danish legislation (where necessary). No non-implemented directives related to SMS' have been identified.
ii. Only IMs with the (at least partial) purpose of passenger transport is considered, excluding veteran and private railways.
iii. Other approvals for railway operation, other than the safety approval for the infrastructure manager, are only considered in the scope of the applicability of this to infrastructure managers SMS, e.g. changes of infrastructure, rolling stock, interoperability requirements, etc. is only considered where it potentially impacts the function of the SMS.

iv. Implementation of the common-basis SMS is not in scope of the project, which only considers the argumentation and choice behind SMS framework that the project aims to develop. Consequently, the subjects of reporting, supervision and documentation are also not considered in-depth.

v. While performing the mapping in Research question 1, all requirements related to economics/insurance, form, time, access for operators, reporting and supervision (see also limitation 3.) has only been considered in the scope of the applicability of this to the creation of infrastructure manager SMS.

2 METHOD AND TOOLS

In this chapter, the methodology, literature research and data collection of this project is described. In addition, this chapter also describe the tools and theories used in this project.

2.1 Methodology

To assure that the project follows a standardized approach to risk management, the risk management process of ISO31000:2018 is used. This model uses a generic approach to risk management which is applicable for any type of subject, providing guidelines and principles that helps the complete risk analysis for a chosen subject. The process is chosen as it does not set detailed requirements for the risk management process (ISO:31000, 2018).

It shall be noted that only the project paper itself follows the standard of ISO31000:2018. For the draft blueprint product, the frameworks and requirements used in the railway industry are primarily considered instead.

The project is compliant with the ISO 31000:2018 standard as shown below:

i. Customizing the process with the scope, context and criteria. This is done by defining the scope by stating Limitations and determining appropriate Method and tools, as well as defining the context of the applicability and purpose of the project. The risk criteria of the project is considered less relevant, as the purpose of the project is not to mitigate a risk but develop a framework in which risks can be managed according to the industry risk criteria. The function of the SMS though, is considered in a Risk .
ii. Identifying the risk related to the function of the SMS.
iii. Analysing the source as well as the cause of the identified risks, including the consequence of a failure.
iv. Evaluating the risk by considering the necessary action according to the risk criteria.
v. Treating the risk. Here the actual common-basis SMS draft blueprint is considered a product, where the argumentation of the treatment of the risk through choices made for the common-basis is the key choice for fulfilling this requirement.
vi. Communication and consultation was performed by semi-structured interviews.
vii. Monitoring and review could have been assured by performing verification of the function and feasibility of the draft blueprint framework of the common-basis SMS. This is though

considered out of scope of this paper, due to the project not considering implementation – see Limitations.

viii. Recording and reporting is considered out of scope of the project, as implementation of the project output has been scoped out of the project – see Limitations.

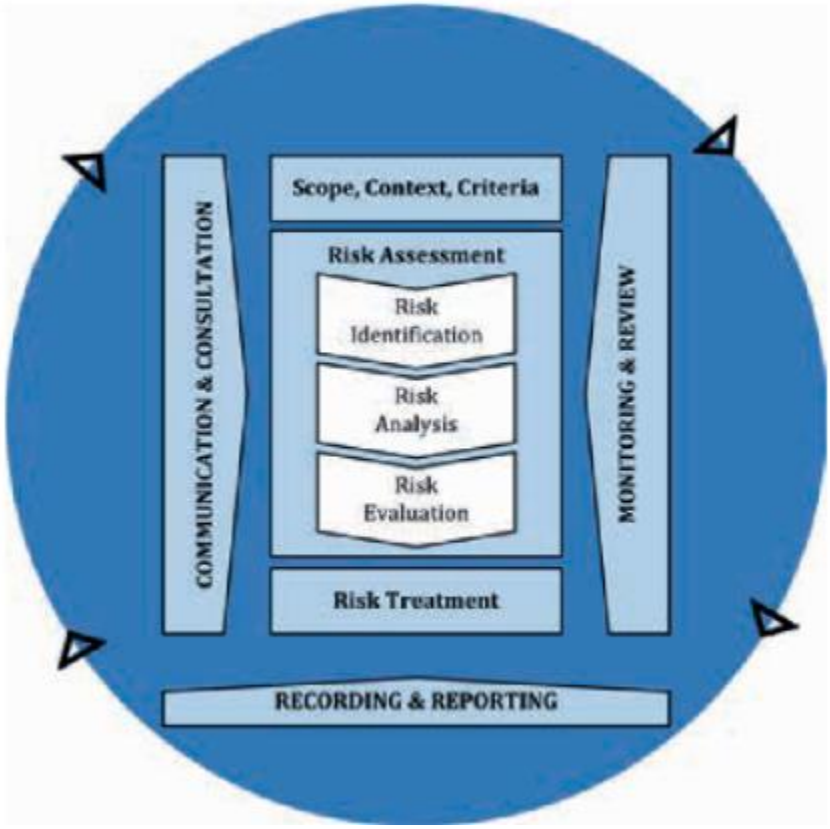


Figure 1 Risk management process c.f. ISO:31000 (Source: ISO 31000:2018, p9, Figure 4)

2.2 Literature search and data collection

The literature search and data collection was based according to the following:

i. The web site of the Danish NSA (currently Trafikstyrelsen) as well as the ERA web site, was used to ensure that the newest information and legal requirements were used.

ii. Accident studies from the Accident Investigation Board Denmark (in Danish; Havarikommissionen) was used to investigate any accidents in recent times caused by faults

in the SMS, in order to gain insight into any obvious implementations to consider in the draft blueprint framework.

iii. General research on the applicability and purpose of SMS within infrastructure managers were found via search engines, primarily with different infrastructure managers and academic publications.

iv. Semi-structured interviews were performed with relevant stakeholders working with SMS for infrastructure managers, in order to gain a broader knowledge of relevant elements of the function of the SMS.

The project does not occupy itself with a specified timeline but instead aims to use the newest available data and information on the chosen subject.

Search-words were centred around the following categories: Safety management system, infrastructure manager, railway, railway legislation (in both Danish and English)

2.3 Tools and theories

This project uses an assortment of tools in form of analytical risk models. These are described in the following sub-chapters.

2.3.1 Bow-tie analysis

Based on the system identification, the bow-tie method was used as a foundational method in order to structure the hazards.

This analysis is a qualitative risk analysis method, chosen due to the relative ease of use and that performing it does not require substantial data. The method is decidedly reliant on the expertise of the participants, but it was considered sufficient for the purpose of initial risk identification as the purpose was to identify hazards related to the SMS.

The bow-tie model is separated into three main parts:

- A cause analysis
- The event
- A consequence analysis

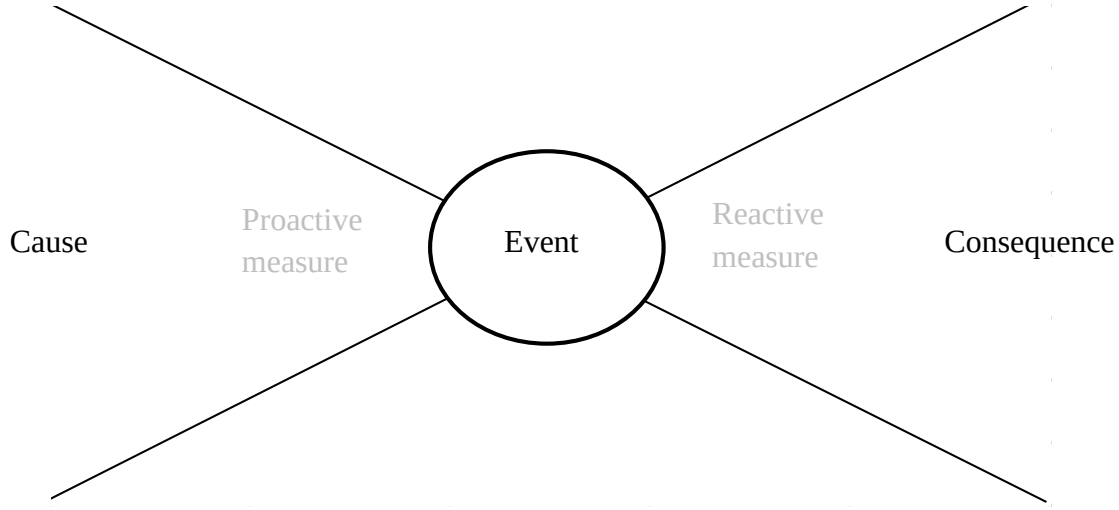


Figure 2 Generic bow tie analysis model

2.3.2 Semi-structured interview

To add knowledge of best-case practice and determine the feasibility of different frameworks for SMS, a range of qualitative semi-structured research interviews were completed.

The choice of this form for data sourcing was to obtain data with as much breadth as possible and consequently the execution of the interviews is through a semi-structured interview form with broad questions, where questions were primarily asked to elaborate, follow up on statements, but sometimes also to bring the conversation on the right track.

In line with the semi-structured approach, the respondent's opt-in and opt-out were warranted, to ensure that the respondent was not hampered in his narrative due to the intersubjectivity created. The interviewer position has therefore varied from opinion pollster to pollster (Kvale & Brinkmann, 2014, s. 133), depending on how clearly relaxed the respondent was.

The interviews were performed via video-call or physically, depending on the availability of the interview subjects, and the interview guide was not divulged.

The respondents were chosen to indicate the broadest possible data, meaning that different types and sizes of rail ways systems was chosen. Small to medium-to-large organizations was chosen, as the author already has experience from the largest (BDK).

Since the purpose of the interviews was to be able to say something general about best practice and understanding of the object, the analysis of the interviews is made by meaning condensation and analytical generalization.

The purpose of meaning condensation is to boil the text down to the vital elements. This method was chosen over coding as it more closely retained the causal relationships as described by the respondent.

The final analysis in the form of the generalization is used as described by Kvale & Brinkmann and is therefore;

> *"... a well-considered assessment of the extent to which the results of one study can be indicative of what can happen in another situation... based on an analysis of the similarities and differences in the two situations..."* (Kvale & Brinkmann, 2014, s. 337).

Consequently, emphasis is placed on the analysis in Research question 2 to highlight the above.

3 SYSTEM IDENTIFICATION

This chapter will serve as an analysis of the system that seeks to establish a thorough understanding of its components and the inherent risks. The systems identification consists of the following;

i. types of rail, including physical characteristic, boundaries and functionality,
ii. stakeholders and users, and
iii. risk assessment, including general hazard mapping.

3.1 Railway

In Denmark, a distinction is mad between two general types of rail; city lines and heavy rail.

City lines are defined as Metro, light rail and S-bane, which transport passengers in cities and suburbs (LOV nr 686 af 27/05/2015, 2015, s. §3). While there are technical differences between the different types of city lines, they are all closed systems of limited size in relatively densely populated areas. As they are closed systems, there are no technical harmonization requirements (interoperability), and no other actors can therefore operate on the line(s) besides a dedicated certified operator.

Heavy rail is defined as regional and national lines, which transport passengers and cargo at a higher speed as well as higher load than city lines. Some heavy lines can be closed lines (harbour, veteran and private rail), but as a general rule they are considered open for several actors to be able to operate on the infrastructure through appropriate certification and training. Consequently, technical harmonization requirements (interoperability) are applicable for the infrastructure and the infrastructure manager is required to define requirements for operations as well as provide relevant training for operation.

For both city lines and heavy rail, one typically considers the system in terms of functional and physical systems. In the following two sections these will be shortly described – it is important to note, that any type of railway system is much more complex and detailed than described below, but a more in-depth description does not serve the general purpose and aim for this project.

3.1.1 Physical characteristics

Railway infrastructure is constructed by several physical sub-systems, with a combined function to transport rolling stock on the rails.

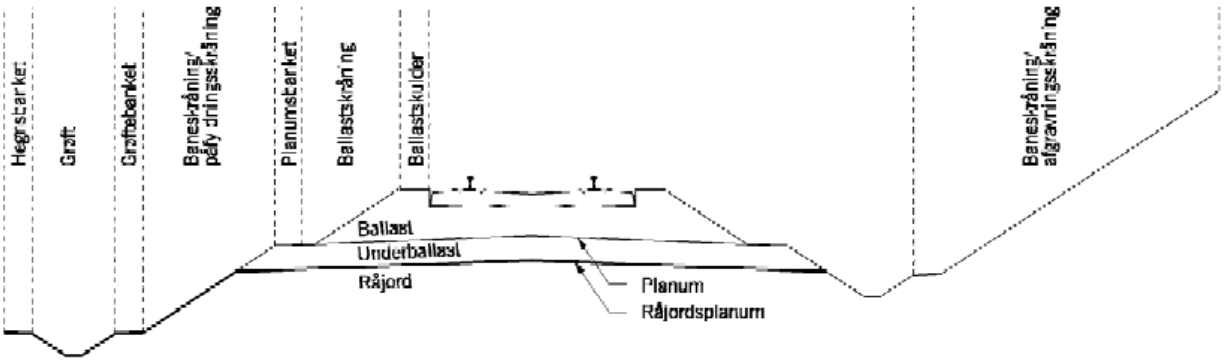
The physical sub-systems can be categorized in different manners, but the overall areas are:

- Track
- Substructure, incl. soil mechanics and earth-bearing constructions
- Catenary system
- Dewatering

Platforms and crossings (bridges/tunnels/level crossings) are typically considered a physical sub-system as well, but while they do have a safety function, they will not be considered further as they are not rail specific or mainly function as an exchange with the surroundings.

All railway types are built with a rail that is connected to sleepers or a substructure with a rail fastening system. Heavy rail typically use ballasted substructures on placed soil, on which sleepers are placed and the rail fastened to the sleeper (ballasted track). The ballast is here both load bearing and draining. Some city lines use ballasted track, especially city lines which cover longer distances, but most use a version of slab track, where the rail is encompassed by a slab of concrete. The slab is poured on placed soil, which makes the slab the main loadbearing component. In these types of constructions drainage is often ensured by drainage pipes.

In Figure 3 and Figure 4 principle sketches show the two different types of design.



Figur 5-1. Principtegning for tværprofil med betegnelser

Figure 3 Ballasted track (Source: Banedanmark; BN1-6-6; 2016; Figure 5-1)

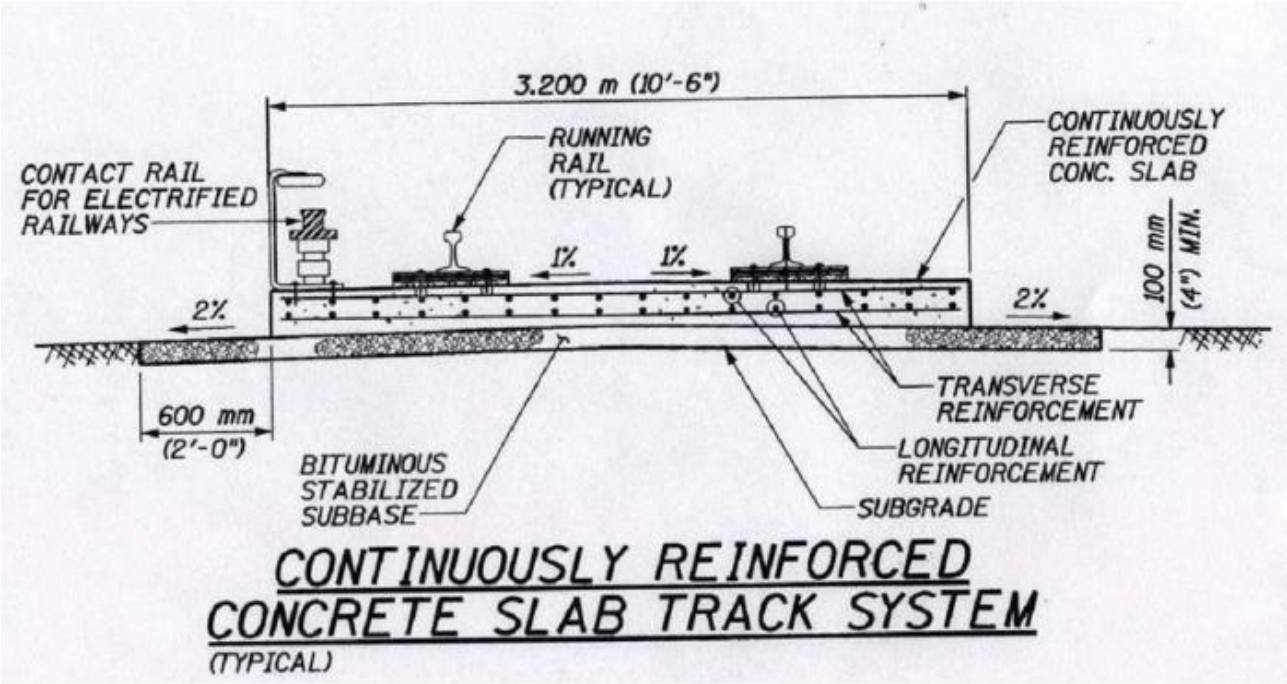


Figure 4 Slab Track (Source: Taybji, Shiraz; Bilow, David; Concrete Slab Track State of the Practice; Transportation Research Record Journal of the Transportation Research Board, January 2001; https://www.researchgate.net/publication/245559182_Concrete_Slab_Track_State_of_the_Practice; Figure 10).

Danish railways in operation are standard gauge (1435 mm) with a maximum speed of 180 km/h on heavy rail and 100 km/h on city lines (often less in urban areas as well as for light rail).

Some lines are electrified, which can be done through a third rail or overhead catenary systems. Due to space constrictions, underground lines often use a third rail, while open air systems typically use the overhead catenary option. The current supply of electricity is mainly public supply, where transformer stations convert the input supply to sufficient voltage levels for operation.
Both AC and DC currents are used, with DC current being dominant on the city lines. Electrification has not been finalized on the state lines in Denmark, with some lines also not being considered for electrification. Only diesel or battery trains can operate in these locations.

3.1.2 Functionality

Railway functionality is constructed by the function of physical sub-systems or specific components, which combined have a safety function in ensuring transport of rolling stock. This should be understood that generally the function of the components is considered to be physical (e.g. rail

geometry must be correct for the function of the rail together with the rolling stock), but the functionality is the system function (e.g. the sub-systems combined function).

The functional sub-systems can be categorized in different manners, but the main functionality lies in the following areas:

- Signalling and interlocking, incl. IT
- Operations and Control Command

The function of a signalling system is control and command of train operations, which ensures safety on a system level, e.g. keep trains clear of each other.
For the heavy rail, the roll-out of the Danish Signalling programme has resulted in, an increasingly larger range of the Danish railway system being operated by ERMTS level 2 rather than ATC, ATP and ATC train stop. The main difference between the systems is that the new signalling system relies entirely on cab signalling, while the old systems rely on track-side signalling.
For city lines, CBTC or track-side signalling is currently used. For light rail that shares the operational area with other actors (shared track) driving on sight with speed reductions can also be utilized, e.g. no dedicated system is used.

Common for both city lines and heavy rail, is that a signalling system must have operational rules attached for control and command to be able to cover situations that does not relate to normal operations, e.g. maintenance works, component failure, etc.

3.1.3 Activities

The following activities are typically performed on any type of railway:

- Construction; both new build and changes to existing infrastructure, which can be performed by both the infrastructure manager and third parties. Due to technical requirements for the safety function of the railway infrastructure, anyone doing construction close to the railway infrastructure are required to assure the continued safety function of the railway during and after the work if the works can impact the infrastructure. For new build, technical requirements must be assured and any connection to existing infrastructure has to be managed according to traffical rules.

- Maintenance; which is very similar to construction in that the actual exchange of infrastructure components require the same considerations as construction. However maintenance does also cover supervision and control of function and/or condition.
- Operation; in which normal traffic is performed. This period varies from the different types of rail, but peak hours are often from the early morning to late evening. It is likely though, that operation is performed in degraded mode or interjected with non-operational periods, as maintenance and construction is often not allowed to alter the traffic capacity in any larger scale.

3.1.4 Regulations, standards and codes

For regulative requirements and specifications for the infrastructure manager, see Appendix 1 – Mapping, part 1.

The infrastructure manager defines the specific norms and standards for their specific infrastructure, both for traffical and technical rules. Depending on the infrastructure manager as well as the technology, this set of rules can cover everything or can only show where it differentiates from for example DS:EN standards. This approach is approved through the safety approval of technical and traffical rules, by the NSA.

3.1.5 Boundaries and exposure

Most rail systems in Denmark are isolated tracks, meaning that they can be recognized by having its own signalling system and does not share spatial course with any other actors (other infrastructures as well as other types of traffic). In these instances, platforms and level crossings (e.g. crossing between rail and road) are the main boundary to external factors.

On light rails (city line), shared space or separated space can also be utilized. Some harbour and private lines also utilize the former. In shared space there is no boundary between the rolling stock/infrastructure and the surrounding traffic. In separate spaces, the rolling stock will be signalled by road signals with the infrastructure placed along road traffic, and thereby the light rail functions as a bus with a dedicated lane.

In general, boundaries are also to the surrounding sub-systems, meaning that if a rail is built on sand, there is an exposure within the physical boundary between soil and rail structure that must be managed – this is further described in Physical characteristics and Functionality.

The general exposure and scenario mapping in relation to the objective and scope, relates primarily to the boundaries. This shall be understood as such, that the purpose of the rail way is to transport passengers and goods from A to be, and any impact on functionalities, would be any disruption of this purpose, e.g. natural hazards, operational hazards, technical hazards, etc. in the boundaries.

3.1.6 Accidents

By looking at accident studies from the Accident Investigation Board Denmark (in Danish; Havarikommissionen) it is possible to see if any accidents between the years 2015 and 2021 was caused by faults in the SMS. No reports previous to 2015 can be found on the web page of the Accident Investigation Board Denmark (Havarikommissionen, 2022).

The reports shown in Table 1were used for the accident study. More reports are available, but the following reports were, through screening of the entire report catalogue, chosen as they concluded a need for further actions and/or further investigations.

Case no.	**Title**	**IM**
2015-20	Persontog kollideret med gravemaskine ved Herfølge *Passenger train collision with excavator at Herfølge*	BDK
2016-242	Person påkørt i perronovergang, Kværndrup *Person hit in platform crossing, Kværndrup*	BDK
2016-250	Tog afsporet under udkørsel fra Lundby station *Train derailment while exiting Lundby station*	BDK
2017-46	Regionaltog kollideret med gravemaskine mellem Skodsborg og Klampenborg *Regional train collision with excavator between Skodsborg and Klampenborg*	BDK
2017-51	Persontog afsporet under indkørsel på Ruds Vedby Station	LT

	Passenger train derailed during arrival at Ruds Vedby Station	
2017-66	Stationsbetjent (elev) omkommet ved afsporing Høje Taastrup *Station officer (student) killed at derailment Høje Taastrup*	DB Cargo
2017-132	Person ramt af tog i overgang mellem perroner *Person hit by train in transition between platforms*	BDK
2018-333	Bil ramt tog i overkørsel 163 ved Sig *Car hit train in junction 163 at Sig*	AAL
2019-2	Lyntog L 210 kollideret med sættevognstrailer fra godstog G 9233 på Storebæltsbroen (Vestbroen) *Train L 210 collision with semi-trailer from freight train G 9233 on the Great Belt Bridge (Vestbroen)*	BDK
2020-170	Intercitytog ramte udlæggerbånd fra sporombygningsmateriel ved Hobro *Intercity trains hit pavement tracks from track conversion equipment at Hobro*	BDK
2021-24	Storebæltsforbindelsen, sættevognstrailer ude af position ved kørsel på Vestbroen *The Great Belt Bridge connection, semi-trailer out of position when driving on Vestbroen*	BDK

Table 1 Accident reports Havarikommissionen

It can be seen that BDK is the main infrastructure manager in the accident reports. It is presumed that this is because BDK is the infrastructure manager for most of the railway infrastructure in Denmark.

The incidents are categorized according to failure type in Table 2. The categories have been chosen based on the following:

- **Training**: Events where knowledge of equipment, rules (operational and technical), procedures, etc. is missing.
- **Procedure**: Events where procedures did not cover as intended.
- **Mistakes**: Events where miscommunication or faulty behaviour (e.g. the training is deemed insufficient) happened.

- **Technical**: Events where technical malfunctions or the design of the infrastructure are the cause of the event.
- **Information**: Events where the sharing of knowledge between different actors could have prevented the event.

Some incidents are placed in several categories as the causes have been determined as a combined cause.

Category	AAL	BDK	DB Cargo	LT
Training		4	1	1
Procedure		2	3	1
Mistake		2		
Technical	1	5	1	1
Information		1	2	1

Table 2 Categorization of accidents

The accident reports generally report two overall incidents; incidents between persons crossing tracks and rolling stock (level crossing accidents), or incidents related to activities on the tracks themselves (rolling stock collisions with other rolling stock or construction equipment). The incidents in the training category relates mainly to faulty use of rules and procedures. The incidents in the procedure and technical categories mainly relate relates to gaps in safety related to unknown situations.

The category related to information is especially interesting, as this relates directly to the safety function of a SMS:

- 2017-51: LT was not informed of the technical rules related to a specific type of prohibition device for switch clamp, that had been discontinued by BDK.
- 2021-24: It is noted that safety risks are not distributed to ERAs information management system, but instead knowledge about safety risks must be pursued on an individual level. NSAs and accident boards are not informed of internationally found risks.
- 2019-2: Safety critical maintenance is not detected as a safety function in DB Cargo SMS.

In addition, two specific recommendations regarding the update of SMS is interesting to note:

- 2017-132: Following several level crossing deaths, it is recommended to the NSA it follows up on the implementation of changes to systems that are not compliant with the safety target/safety function, as no evidence is found that the previous analysis have been included in the BDK SMS.
- 2021-24: Following a repeat of a semi-trailer being out of position on the Great Belt Bridge, it is recommended to the NSA that it follows up on the implementation of DB Cargo SMS being updated to cover the relevant risks as well as their ability to manage risks based on reporting from accidents and near-accidents.

Based on the above, it can be concluded that some incidents can be considered to be caused by faults in the SMS or the structures surrounding the SMS.

3.2 Risk assessment

The risk assessment will consist of two parts:

i. A hazard identification, identifying the hazards and factors for the function of the SMS.
ii. A risk evaluation, evaluating the hazards found in the identification.

The risk identification is founded in the function of the SMS in relation to the previous chapters describing the Railway system.

While the SMS is a legal requirement, the assessment of risk is performed to ascertain the legitimacy of the found hazards.

3.2.1 Hazard identification

The basis of the hazard identification is not the function of the SMS itself, but events where the safety function(s) is not upheld. Consequences were identified but were not the focus. Proactive and reactive measures were not identified, as they would generally be added as a part of the SMS function and requirements. The analysis does not cover all scenarios, but is an initial analysis based of the system description of the Railway.

BEK711 (BEK711, 2020) states that:

> *"Jernbaneinfrastruktur må ikke tages i brug, før Trafik-, Bygge- og Boligstyrelsen har udstedt ibrugtagningstilladelser til de i jernbaneinfrastrukturen anvendte strukturelle delsystemer. (Railway infrastructure cannot be put into service before the NSA has given an approval for putting into service for the used structural subsystems in the railway infrastructure).*" (Ibid., §12),

and that:

> *"Jernbaneinfrastruktur, der ikke er omfattet af forordningen for risikovurdering (CSM-RA), skal opfylde kravene til risikovurdering i bilag 1-3 til denne bekendtgørelse. (Railway infrastructure that is not covered by the Risk Assessment Regulation (CSM-RA) must meet the requirements for risk assessment in Annexes 1-3 to this Executive Order.).*" (Ibid., §3)

CSM-RA (CSM-RA, 2020) additionally states that:

> *"The CSTs shall establish the minimum safety levels to be reached by the system as a whole, and where feasible, by different parts of the rail system in each Member State and in the Union…."* (Ibid, article 7, section 1).

The infrastructure manager is consequently responsible for assuring a safety level of the infrastructure, as well as keeping compliance with the stated safety level. This safety level, and thereby the control of the hazards related to any works, shall be documented and approved by a relevant authority.
This therefore means, that the infrastructure manager has to ensure the sufficiency of the safety function of, where possible, all sub-systems in order for operation to be possible.

Based on the description given of the system, there are several functions that both individually and combined shall be assured. Moreover considering the defined Activities, this means that both the static system as well as the operation of the system is to be considered in a hazard identification:

- For construction both design and build has to assure the safety function of any relevant subsystems. This is also relevant for maintenance, where the maintenance does not consist of an identical exchange which consequently categorises it as a change.

- For operation the normal function of signalling/interlocking/IT is equally as important as the control and command rules, meaning that changes shall be ruled in a way that assures that safety functions are not degraded. This adds a need for both rules and training
- Degraded mode, e.g. due to both accidents and construction/maintenance, shall be managed in a way that the safety function is upheld.
- Supervision and control of the infrastructure is needed to detect failures and/or degradation of the safety function.

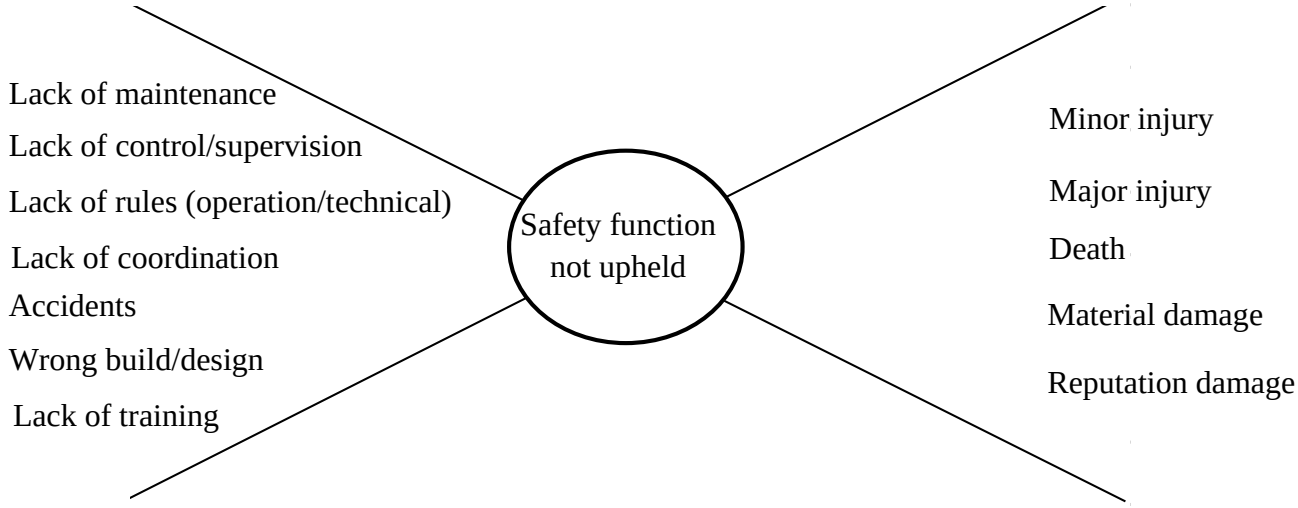


Figure 5 Hazard identification in bow tie format

3.2.2 Risk evaluation

The Hazard identification bow tie analysis show that several causes can be found for the event of safety functions not being upheld.

The consequence of the event varies depending on the size and factors of the event, e.g. a settlement in the track can lead to a few minor injuries as well as several dead with massive material damage, including large-scale interruptions to operations depending on the scale of settlement, speed, etc. Generally a worst-case scenario cannot be considered acceptable.

The above analysis show that, not only from a legislative viewpoint but also from a risk management viewpoint, there is a need to structure the activities and requirements to the railway system to assure the safety function of the same system. This is also supported by the requirement for national safety

targets (CSM-RA, 2020) which states that maximum 0,3 deaths and/or 3 major injuries are acceptable per million kilometres of operation on the combined Danish infrastructure (Trafikstyrelsen, Sikkerhedsrapport for jernbanen 2020, 2021).

3.3 Stakeholder analysis

As part of this project, the stakeholder analysis is performed to identify the key actors around and in a SMS. The purpose of the stakeholder analysis is to list key players, to be able to identify potential conflicts of interest in an early phase. To attain this, the stakeholder analysis will include the following:

i. Mapping of relevant stakeholders that are affected either directly or indirectly by a SMS.
ii. Engaging the stakeholders in a power-interest grid and considering their relevance of impact.

3.3.1 Stakeholder analysis

Table 3 show the mapped list of relevant stakeholder. The stakeholders are listed in no order of particular importance based on three categories. The categories have been determined based on their association to the railway industry.

Railway actors	**Public actors**	**Private actors**
Customers	Government	Entrepreneurs
Employees		Supply chain bodies
Infrastructure managers		Lineside neighbours
ERA		
NSA		
Commuter associations		

Table 3 Stakeholder mapping, grouped

3.3.1.1 Railway actors

This category describes the actors that are using the railway infrastructure or working on it. These groups are directly impacted to the function of the SMS.

3.3.1.1.1 Customers

The group consist of users of the railway, mainly meaning passengers. Looking at Table 4, this group is relatively large, albeit return customers would be highly expected to be shown in passenger numbers due to the city lines expectedly having many commuters.

Infrastructure manager	Passengers	Year	Source
Aarhus Letbane	4.788.295	2019	(Aarhus Letbane, 2022)
Metro (M1/M2/M3/M4)	64.700.000	2018	(Metroen, 2022)
Heavy rail (Banedanmark, local rail)	93.820.000 (est.)	2019	(DST, 2022)

Table 4 Passenger numbers pre-COVID

It shall be noted that the listed passenger numbers are from before 2020, due to the fact that there has been a sharp decline of passengers due to restrictions and fear of contagion following the COVID pandemic, and numbers for 2021 are not finally reported on all lines.

It is worth noting that Metro seems to have had the least amount of decline in passenger numbers during the pandemic (DST, 2022). This could likely be explained with the lack of other options that inner-city Copenhagen offers, meaning that working from home might not have been an option for everyone and it is not practical to own a car in the city. Outside the Copenhagen area, there might also have been a tendency to already own alternative vehicles for transportation, as public transport is not as available. Consequently, the passenger interest in operations can likely be considered stronger in larger cities.

3.3.1.1.2 Commuter associations

Commuter associations are common on the state lines – on lines where the operator DSB are certified, there are 32 associations alone (DSB, 2022). While the commuter associations do not have official or legislative power, they are invited to give feedback to improve passenger satisfaction.

3.3.1.1.3 Employees

The group consist of people that work on or with the railway.

Employees can be divided into two categories; direct and indirect contact. Employees with direct contact work with the physical/functional infrastructure, e.g. as railway workers, etc., while employees with indirect contact work with tasks that surround the physical/functional infrastructure, e.g. academic work, etc. Both groups can have a safety bearing role, but it is more likely that the direct contact employee will have a safety bearing role.

Despite their different locations and roles, all employees have the railway industry as a source of income, either as a primary or secondary. This makes the employees dependant on the popularity of the railway industry in order to ensure and keep their income. Whether the interest of the employees is beyond income, meaning that work environment, safety and personal development is equally valuable, is not ascertained.

3.3.1.1.4 Infrastructure managers

In 2020 there were 8 infrastructure managers in Denmark (Trafikstyrelsen, Fakta ark 2020, 2021). With the opening of Odense Letbane, 9 infrastructure managers is expected in 2022. The infrastructure manager is the owner of the SMS, and responsible for the function and upkeep of this as well as the infrastructure itself according to BEK712.

The infrastructure manager has to ensure that the infrastructure is available for operations as well and must therefore find a balance between punctuality and safety.

3.3.1.1.5 NSA

The Danish NSA Trafikstyrelsen is responsible for approving, supervising and revoking safety approvals for infrastructure managers according to BEK712. In addition, the NSA reports to ERA on the status of the safety on the Danish mainline railway system as well as functions as the key point of contact in the European collaboration.

The NSA shall be expected to have a very strong agenda as well as very high influence on the infrastructure managers SMS.

3.3.1.1.6 ERA

The European Union Agency for Railways is tasked with promoting harmonization across European railways, devise technical and legal frameworks across the nation states as well as act as the European authority for vehicle type authorizations including single safety certificates (ERA, 2022).

ERA therefore mostly act on a legal and political level but can be expected to have a very strong agenda.

3.3.1.2 Public actors

This category contains a description of actors that have an interest in the railway infrastructure but does not work directly with it. These groups are not directly impacted to the function of the SMS but can set requirements.

3.3.1.2.1 Government

The governments can be divided into local and national. The national government's interests is traditionally at a macro-level, meaning that the political, economic and punctuality levels are key. Safety would also be considered a factor at this level but would likely manifest as a reactive measure rather than proactive, e.g. if a serious fault was found a solution would be demanded but there would be no decided interest in the detail work. The local government, e.g. municipality, would likely be focused on attracting the advantages of the rail industry in the area, e.g. city expansion and/or economy.

3.3.1.3 Private actors

This category describes the actors that have an interest in the railway infrastructure or working on it. These groups are not directly impacted by the function of the SMS but are impacted by requirements set by either the SMS or the infrastructure manager/legal entities.

3.3.1.3.1 Entrepreneurs

While some infrastructure managers perform their own maintenance and/or construction, it is generally more common to submit tenders for entrepreneurs to perform the necessary work – in 2020 there were 22 safety certificate holders in Denmark (Trafikstyrelsen, Fakta ark 2020, 2021). This means that entrepreneurs (like Aarsleff Rail, Strukton Rail, etc.) routinely work on and around the railway infrastructure in Denmark. They are directly impacted by any requirements given in the SMS, and therefore will also have an interest in keeping the requirements simple and/or limited.

3.3.1.3.2 Supply chain bodies

This group describes corporations that supply materials to railway infrastructure. This is a wide array of corporations, which can deliver anything from soil and gravel to IT components.

The interest from the supply chain bodies will likely mainly be related to economic gain.

3.3.1.3.3 Lineside neighbours

As a lineside neighbour there are often some requirements (easements) related to the vicinity of the railway infrastructure. In addition, some levels of noise cannot be avoided. It is likely that the interest in the railway infrastructure is limited outside these conditions.

3.3.2 Power-interest analysis

The stakeholders listed in Stakeholder analysis have been grouped in a power/interest grid in Table 3.

The groupings are determined according to the following criteria:

i. **High power/high interest**: Primary stakeholders as both power and interest are high. Gaining support is crucial for success. Shall be managed closely.

ii. **High power/low interest**: Secondary stakeholder power is high, but interest is low. Support is not crucial for success but can impact negatively if not satisfied. Shall be kept satisfied.

iii. **Low power/high interest**: Tertiary stakeholders power is low, but interest is high. Gaining support is not crucial for success but due to interest this group can create negative impact. Shall be kept informed.

iv. **Low power/low interest**: Least important of the stakeholders as both power and interest are low. Should not be excluded. Shall be kept monitored.

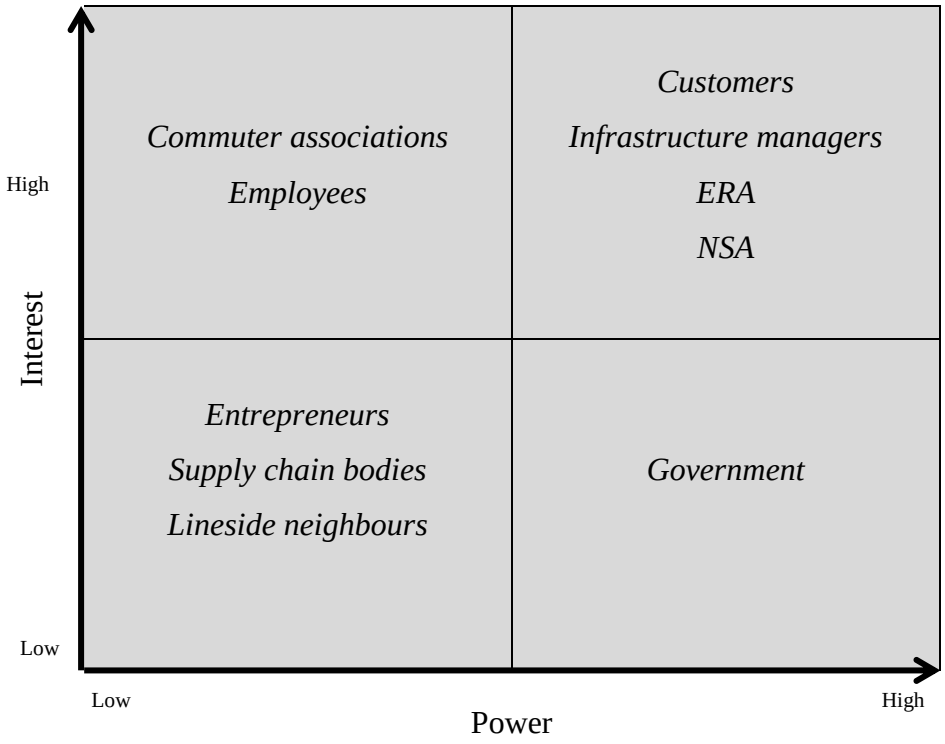


Table 5 Power-interest grid, stakeholders

It is important to note that the high power/high interest group are also the key actors in the function of the SMS, as they both regulate, supervise, develop and approve it. This is in line with the SMS being a legal requirement. The exception to this is the customers, who have no role in the SMS, but instead have a vested interest in the safe function of the railway systems. It should be noted though,

that the commuter associations despite having low power, function partly as a voice for the customers in general.

There is an interesting split in the split between the infrastructure manager (as an organisation) and its employees, where the former is high power/high interest, and the latter is low power/high interest. This is considered to be explained by the fact that most individual employees will not have a direct impact on the function of the SMS, if the SMS indeed functions as it should – it is another matter if the SMS does not function, i.e. staff "does not do what is written", but generally this would be managed by deviations and corrections of the SMS content.

3.3.2.1 Decision making

Decision makers, in general is the infrastructure manager itself. While the infrastructure manager is regulated by legislation, as well as the safety approval framework developed by the infrastructure manager itself, the decision-making lies with the infrastructure managers organization.

In some instances the infrastructure manager is not the infrastructure owner, meaning that it is then the contract between the infrastructure manager and infrastructure owner that defines the decision maker as well as the extent of the allowed decision making for both parties. Any contract does though not negate to safety responsibility of the infrastructure manager, meaning that the owner cannot decide on matters that relates to the infrastructure manager safety approval and safety activities.

4 PROBLEM FORMULATION

Based on the former chapters, this chapter will contain the problem description and formulation, as well as the research questions.

4.1 Problem description

The System identification show that a railway infrastructure is a set of sub-systems that combined create a complex system with a set of specific activities. While there are technical differences between the systems, the safety function of the general technical requirements are relatively similar.

The Risk assessment show that the causes of the safety function is varied, and the consequence can be considered unacceptable in a worst-case scenario.

The Stakeholder analysis show that the key actors are also the key stakeholders, but also that the users of railway systems has a vested interest in the safety function of the system.

4.2 Problem formulation

The System identification shows a general need for safety management systems. The Risk assessment does not show a concrete need for a unified approach for SMS, but instead the Accidents analysis show that there is an inherent risk of lack of information and thereby gaps in SMS across organizations.

The following problem formulation was therefore relevant to investigate:

Can a common-basis approach be used in order to assure operational safety management systems functions in accordance with legislative requirements across different infrastructure managers?

In order to answer the above problem, the following work questions were chosen:

i. *What requirements are placed on safety management systems?*
ii. *What is the best-case approach of managing the mapped requirements?*
iii. *How can a common-basis SMS be scaled for different infrastructure managers?*

The research questions will be answered in the following manner:

i. A mapping of requirements related to SMS for different types of infrastructure managers.
ii. Input from stakeholders working with SMS for infrastructure managers.
iii. Input from stakeholders working with SMS for infrastructure managers.

Bullet i., ii. and iii. will be developed in to a draft blueprint SMS.

5 ANALYSIS

In this section the research questions will be answered, and the draft blueprint product will be shown.

5.1 Research question 1

In this chapter the following research question shall be answered:

i. *What requirements are placed on safety management systems?*

This is done by performing a mapping of requirements related to SMS for different types of infrastructure managers. In this section this mapping will be explored.

5.1.1 Legislation

In Appendix 1 – Mapping, part 1 legislation and guidance's have been identified that are pertinent for railway. The table has been compiled with searches from the ERA web page, the Danish NSA homepage as well as the web page Retsinformation.dk, which is the joint access to the Danish common state legal information system, which provides access to all applicable laws, executive orders and circulars, etc.

The focus for the searches on the abovementioned web pages was purposely kept broad, albeit Directives, etc., related to interoperability was not included.

In the mapping of the requirements related to SMS the following subjects were included from the initial identification shown in Appendix 1 – Mapping, part 1:

- LOV nr 686 af 27/05/2015 (Jernbanelov)
- Bekendtgørelse 711 om ibrugtagningstilladelse for delsystemer i jernbaneinfrastruktur
- Bekendtgørelse 712 om sikkerhedsgodkendelse, EU-sikkerhedscertifikat og sikkerhedscertifikat på jernbaneområdet

This means that the mapping that can be found in Appendix 2 – Mapping, part 2 does not contain direct requirements related to assessor, rolling stock, etc., as per the projects Limitations. In addition, European Directives are not specifically mapped as they are implemented through national legislation.

5.1.2 Mapping results

Based on the mapping in Appendix 2 – Mapping, part 2, this section will detail the requirements that has been identified.

Lov868 states that:

> *"Trafikstyrelsen fører tilsyn med, at indehaveren af et sikkerhedscertifikat eller en sikkerhedsgodkendelse jf. §§ 39 b og 59 overholder gældende lovgivning på jernbaneområdet vedrørende interoperabilitet, beredskab, jernbanesikring og jernbanesikkerhed, herunder farligt gods, helbredskrav, uddannelseskrav, anlæg til sikring af vejtrafikken i niveauoverkørsler, godkendelse af jernbanekøretøjer og jernbaneinfrastruktur m.v…. (The NSA supervises that the holder of a safety certificate or safety approval, cf. sections 39 b and 59, complies with current legislation in the railway area concerning interoperability, emergency preparedness, railway security and railway safety, including dangerous goods, health requirements, training requirements, facilities for securing road traffic in level crossings, approval of railway vehicles and railway infrastructure, etc…."*
> (LOV nr 686 af 27/05/2015, 2015, s. §70, section 2)

Consequently, it can the understood that while BEK712 is the primary legislation for SMS, the function of the SMS must cover several areas outside the formal requirements shown in BEK712/-172. So the requirements are broader than the legal text itself. This will be reflected in the below sections.

5.1.2.1 Overall safety responsibility

The infrastructure manager has the responsibility for the safe operation of their part of the railway system, e.g. the infrastructure, as well as the responsibility for controlling the risks arising from this system. Consequently, the infrastructure manager is therefore obligated to take the necessary risk management measures and, where appropriate, to involve and co-operate with the other parties in the railway field regarding these measures.

This responsibility of the infrastructure manager also cover third parties, meaning that in instances where risks arise from the activities of other parties, where it can reasonably be expected, the

infrastructure manager must involve and co-operate with the relevant other parties to take the necessary risk management measures.
It shall be noted that the responsibility towards third parties only cover in the extent that it is the activities of the infrastructure manager itself that is the basis. E.g. when third parties are the owner of the activity, it is the other actors that can have impact on the railway system that is responsible for the impact itself as well as corrective actions, etc., to ensure the safety of the use of the railway system (LOV nr 686 af 27/05/2015, 2015, s. §7, section 2). An example of this is, if there is a transformer station next to a new line, the infrastructure manager must ensure that the signalling system can function safely considering any electrical impact from potential stray current, EMC, etc. But if the transformer station is built next to an existing line, it is the third parties responsibility to ensure the same safety function of the signalling system.

In addition, the infrastructure manager must publish its requirements for traffic on track sections which it manages as well as any technical regulations for traffic, e.g. there must be a register of the system details that are safety relevant in the interface between rolling stock and infrastructure. I.e. any technical and traffical requirements must be developed and shared. Here it is important to note, that the infrastructure manager is not responsible for the approval or compability of rolling stock (outside what the infrastructure manager owns), but the infrastructure manager is responsible for an overview of vehicle types including evidence that the rolling stock used on its infrastructure is approved for operation according to the technical requirements.
While it is not spelled out in the legal texts, outside the requirement for technical regulations for traffic, technical rules are overall a requirement – see also the section Changes.

5.1.2.2 Traffical management

The infrastructure manager has the responsibility for safe traffic management on the part of the railway infrastructure which it manages, which includes the responsibility for safety regulations for public access areas.
The means that the infrastructure manager must have a traffical rule set that includes both operation and safe passage, including rules for working on the infrastructure,

Additionally, in BEK712 there is a special focus on level crossings, in which the infrastructure manager is wholly responsible for the safety of these in terms of traffical rules and technical measures

for the railway side of the level crossing – it is important, to note that road safety is not in scope of the infrastructure managers responsibility, but is instead a separate approval with the road authorities. It should be noted that this responsibility overall only extend to rules, mitigations for detection of trains and ensuring closed level crossings for the public cannot be accessed easily, e.g. in operation there is no responsibility for persons that does not follow the set rules or heed the given warning.

5.1.2.3 Changes

Changes can be understood as both changes to rules, organisation and the infrastructure itself. For organisation, BEK712 states that the infrastructure manager;

> *"… skal omgående underrette Trafik-, Bygge- og Boligstyrelsen, hvis:*
> *1) Der er væsentlige ændringer i virksomhedens størrelse.*
> *2) Virksomheden har til hensigt at ændre omfanget af sine aktiviteter væsentligt.*
> *3) Der i øvrigt er væsentlige ændringer i forudsætningerne for sikkerhedsgodkendelsen eller sikkerheds-certifikatet.*
> *(…must immediately notify the Danish Transport, Building and Housing Agency if there are significant changes in the subsystems for infrastructure, signalling equipment or energy or in the principles for their operation and maintenance…. if:*
> *1) There are significant changes in the size of the company.*
> *2) The company intends to change the scope of its activities significantly.*
> *3) There are also significant changes in the prerequisites for the security approval or security certificate.)"* (BEK712, 2020, s. §13, section 3)

Consequently, it can be derived that there is a need to monitor the organization in regard to the extent of the safety approvals applicability, to assure that the safety approval is kept up to date. While bullet 1 and 2 are quite straightforward, e.g. the addition of for example 50% capacity or adding freight to a previous only passenger line; bullet 3 shall be understood as changes in activities.

For rules, the basis is that the NSA approves all changes, but the regulation allows that the infrastructure manager can choose to develop and change own safety rules, including traffic safety

rule, according to the company's safety management system. This does though require that the SMS has been developed and approved for this activity.

For changes to the infrastructure, any changes and/or tests must be approved before putting the changed infrastructure into service, e.g. before using a structural subsystem in the railway infrastructure, the infrastructure manager must implement the necessary risk measures in accordance with the rules on the safety approval. This means that there must be technical and traffical rules in place, as well as a process for changes and the approval of these changes, as a part of the safety approval.

5.1.2.4 Reporting/monitoring

The infrastructure manager is responsible for reporting the following in an annual safety report;

> *"…1) oplysninger om, i hvilket omfang organisationens samlede sikkerhedsmål er nået, og om resultaterne af handlingsplaner,*
> *2) en beskrivelse af udviklingen i nationale sikkerhedsindikatorer og udviklingen i fælles sikkerhedsindikatorer, som er fastsat i gældende EU-regler, og som Trafik-, Bygge- og Boligstyrelsen har vurderet at være relevante for virksomheden,*
> *3) resultaterne af intern audit, og*
> *4) bemærkninger om fejl og mangler ved jernbanedriften, som kan være relevante for sikkerhedsmyndigheden.*
> *(…1) information on the extent to which the organization's overall security objectives have been achieved and on the results of action plans;*
> *2) a description of the development in national safety indicators and the development in common safety indicators, which are stipulated in current EU rules and which the Danish Transport, Building and Housing Agency has assessed to be relevant to the company,*
> *3) the results of internal audits; and*
>
> *4) remarks on faults and deficiencies in railway operations which may be relevant to the safety authority.)"* (BEK712, 2020, s. §18, section 1)

meaning that the infrastructure manager must report to the Danish NSA the preventive measures on accidents as well as precursors to accidents and safety irregularities. In addition, a requirement for

audits have been specified in bullet 3, from which it can be derived that monitoring of safety targets and incidents are required.

5.1.2.5 Training and health

Regarding training, the infrastructure manager has two responsibilities. First, adequate education must be planned for the activities performed, in order for the staff to obtain the necessary professional qualifications. The NSA approves training to perform safety-classified functions. Second, an overview of staff categories must be maintained, and evidence of education must be maintained. Consequently, it can be derived that competence management must be performed.

Regarding health, the infrastructure manager also has two responsibilities related to anyone who performs safety-classified functions in the field, e.g. staff categories like train drivers and control and command operators. First, health approvals must be secured and maintained. Secondly, ensure that anyone that perform safety-classified functions does so in a fully safe manner, e.g. not under influence, illness, weakness, overexertion or lack of sleep, etc.

5.1.2.6 Emergency preparedness

Infrastructure managers are responsible for carrying out the necessary planning and take the necessary measures to secure the railway and railway operations in emergency situations as well as any exceptional situations. This shall be coordinated between infrastructure managers and other actors, e.g. the Danish Emergency Management Agency, the Danish Police, operators, etc.

As a part of the emergency preparedness, the infrastructure managers are responsible for carrying out the necessary planning and take the necessary measures to secure the railway and railway operations in emergency situations as well as any exceptional situations.

5.1.2.7 Rolling stock

Type approval, approval for putting into service and certification of rolling stock is not in the infrastructure managers scope, unless they have rolling stock – for example maintenance vehicles. Then, the infrastructure manager is responsible to acquire all relevant safety approvals in accordance with rolling stock regulations.

5.1.3 Sub-conclusion/learning points

The requirements that is placed on the safety management systems for an infrastructure manager in visualized in Figure 6.

Figure 6 Visualization of legal requirements

There is no difference between types of infrastructure in terms of legal requirements to SMS, as long as the activities remain the same, e.g. if there is the activity *transport of dangerous goods* on an infrastructure, then the legal requirements are the same for both a city line and a conventional line. That said, the technical design of the system also configures the requirements, e.g. for traffic management BEK712 has a focus on level crossing, but level crossings shall be understood to be differently defined across different infrastructures. On Odense Letbane there are no level crossings in the railway definition, but only road crossings, while on Aarhus Letbane as well as most conventional railways there are level crossing. Consequently, the legislation requirement differs, as Odense Letbane is wholly covered by road approvals in crossings, but infrastructure managers with level crossings have a combined set of requirements related of railway and road approvals (the latter must be gained, but in accordance with external requirements). This does not change, that the correct

set of technical and traffical rules are necessary for the infrastructure in question, only that sections of legislation can be considered not applicable depending on activities as well as technical design.

5.2 Research question 2

In this chapter the following research question shall be answered:

i. *What is the best-case approach of managing the mapped requirements?*

This is done by looking at the input from stakeholders working with SMS for infrastructure managers, together with relevant guidance's on SMS.

5.2.1 NSA guidance

The following overall purpose of the content of the SMS should be able to do as follows:

> *"Formålet med et sikkerhedsledelsessystem er at:*
>
> - *Skabe overblik over organisation og aktiviteter samt opretholde effektive risikostyringsforanstaltninger*
> - *Fastlægge hvor virksomheden vil bevæge sig hen (politikker og mål) og formidle dette, således at alle arbejder i samme retning*
> - *Dokumentere opgaver, ansvar og kompetencer i organisationen, således at det sikres, at alle kender deres ansvarsområder, og at alle har de fornødne kompetencer og beføjelser i forhold til det arbejde de skal udføre*
> - *Dokumentere arbejdsgange, således at det sikres, at de enkelte medarbejdere kender disse*
> - *Kontinuert/periodisk evaluere virksomhedens "tilstand", således at stærke og svage sider identificeres, så passende tiltag herefter kan iværksættes med henblik på at forbedre sikkerheden (/fortsætte arbejdet i den fastsatte retning)*
>
> *Overordnet skal systemet således sikre:*
>
> - *Opretholdelse af sikkerheden i den daglige drift (operationelle processer)*
> - *Kontinuerlig forbedring af sikkerheden (ledelsesprocesser)*
>
> *(The purpose of a safety management system is to:*

- *Create an overview of organization and activities as well as maintain effective risk management measures*
- *Determine where the company will move (policies and goals) and communicate this so that everyone works in the same direction*
- *Document tasks, responsibilities and competencies in the organization, so that it is ensured that everyone knows their areas of responsibility and that everyone has the necessary competencies and powers in relation to the work they have to perform*
- *Document workflows so that it is ensured that the individual employees know these*
- *Continuously / periodically evaluate the company's "condition", so that strengths and weaknesses are identified, so that appropriate measures can then be implemented with a view to improving safety (/ continuing the work in the set direction)*

Overall, the system must thus ensure:

- *Maintaining safety in daily operations (operational processes)*
- *Continuous improvement of safety (management processes))*

(Trafikstyrelsen, Vejledning i Sikkerhedsledelse, 2020, s. 8)

This means that the following steps must be performed and/or ensured. It should be noted that the below is a summarization which tries to link the guidance's requirement description together, meaning that not all areas of the guidance's are shown individually and/or explicitly. In addition some parts are left out according to the Limitations.

5.2.1.1 Format

The NSA do not set format requirements. A paper-based system is equally valid as a digital system, albeit it is noted that a paper-based system can be administratively more complex (Trafikstyrelsen, Vejledning i Sikkerhedsledelse, 2020, s. 9). The only guidance given, is that the SMS must be natural to use, which can be understood that it must be user-friendly and easily accessed. Consequently, an organization can build the size, type of complexity that fits their need.

Further there is no requirement to integrate or separate the SMS with other management systems, and processes/procedures can be common where possible (e.g. audits, deviations) (ibid).

That aside, a requirement for document control does exist (Trafikstyrelsen, Vejledning i Sikkerhedsledelse, 2020, s. 18-19). This means that that there must be clear processes/procedures/instructions to describe the build of the SMS and how ownership, validity and changes of the SMS, including supporting documents, are controlled.
Further, a requirement for accessibility also exists (ibid., p.21), meaning that access to the SMS must always be possible where necessary

5.2.1.2 Activities

The NA states that;

> *"At have et sikkerhedsledelsessystem handler om at have planlagt udførelsen af aktiviteterne, så de er sikre. Formålet med at kortlægge aktiviteter og grænseflader er, at I efterfølgende kan kortlægge de risici, som er forbundet med jeres aktiviteter. (Having a safety management system is about having planned the execution of the activities so that they are safe. The purpose of mapping activities and interfaces is that you can subsequently map the risks associated with your activities.)"* (Trafikstyrelsen, trafikstyrelsen.dk, 2022, s. ; Virksomhedens aktiviteter og grænseflader)

This means that the activities that are performed shall be mapped and described, including the details on the activity. The interfaces of the activities shall also be described, meaning that for example the interface between track and rolling stock shall be described in both physical and functional as well as in terms of the activities required to operate, maintain, train, etc. the system in a safe state. This requires external boundaries are also described, in order for an infrastructure manager to be able to export requirements to operators – as well as show that any risks are managed.
It is important to exclusively map the activities the infrastructure manager performs themselves, in order to not add responsibilities that belongs with other actors. Responsibilities that have an impact on the safety approval/SMS that belongs with other actors shall solely be mapped in the interfaces. In addition, only core activities shall be mapped.

While it is not clearly stated in neither (Trafikstyrelsen, Vejledning i Sikkerhedsledelse, 2020) nor (Trafikstyrelsen, trafikstyrelsen.dk, 2022), the mapping of activities as well as the boundaries/interfaces is assumed to require at a minimum a technical and technical description that details the physical, functional system as well as the purpose of the system. Only the guidance that the approach shall be methodological, is given:

> *" En metodisk fremgangsmåde bør kunne sikre, at alle relevante aktiviteter i organisationen og relevante grænseflader bliver identificeret, og nedbrudt på et relevant operationelt niveau. (A methodological approach should be able to ensure that all relevant activities in the organization and relevant interfaces are identified and broken down at an appropriate operational level)"*
> (Trafikstyrelsen, Vejledning i Sikkerhedsledelse, 2020, s. 6)

5.2.1.3 Risk profile

Based on the activities and interfaces, risk identification, including risk treatment, shall be performed with the purpose of building a risk profile. The risk profile shall cover all relevant phases, e.g. operation, maintenance, traffic and technical failures, etc. as well as risks related to the boundaries/interfaces.
The risk profile is a "living document", meaning that it must at all times be updated to the current situation. Trends in terms of incidents and accidents as well as changes to activities, boundaries/interfaces, technical and traffical systems, etc., means that the risk profile can potentially be subject for change – both in terms of causes, barriers and the hazards themselves.
The risks identified shall be treated in a manner, so that they are acceptable.

It is recommended to create traceability between the hazards in the risk profile to where the barriers are executed, to be able to determine the if the risk is impacted by changing a barrier (Trafikstyrelsen, Vejledning i Sikkerhedsledelse, 2020, s. 12). An example of this, is if a risk is acceptable due to the barrier "*training in x component*". If the component or training is changes, the risk must be evaluated to determine if it is still in control.
Therefore there are also a requirement for registration of incident and accidents, failures and errors, as well as deviations.

5.2.1.4 Competence and task management

Competences and tasks are also linked to roles, responsibilities and mandates, and can be understood to be the same. It is though relevant to mention that functions and roles are required to be mapped in terms of the tasks (safety responsibilities) that they are responsible for (Trafikstyrelsen, Vejledning i Sikkerhedsledelse, 2020, s. 13-14).

The overall requirement for tasks is that tasks are done by the correct competences. This means that the SMS shall;

> *"… sikre, at relevante behov for uddannelse og træning bliver identificeret og gennemført, så alt personale er kvalificeret. (…ensure that relevant needs for education and training are identified and implemented so that all staff are qualified.)"* (Trafikstyrelsen, trafikstyrelsen.dk, 2022)

On the basis of the mapped activities and boundaries/interfaces, as well as the barriers set up in the risk profile, competence needs (or roles) can be mapped. These competences can be linked to roles or functions, meaning that a task and competence is mapped to a role/function (e.g. maintenance staff must have competence to do a specific task). The role/function must then be given the necessary mandate to fulfill this responsibility.

It is required that a process for change of competences as well as ensuring competences are present in the SMS (Trafikstyrelsen, trafikstyrelsen.dk, 2022, s. ; Sikring af kompetencer).

Competences can be graduated. One role/function can be managed by a lesser competence level in a certain area, than another role/function. An auditor would for example be required to have a higher competence level for the SMS content, than a maintenance worker.

This also means that the infrastructure manager shall ensure education is planned and performed for relevant competences/roles. The infrastructure manager shall also ensure safety approval for any educations that are safety bearing (i.e. operational, like train driver).

5.2.1.5 Documentation

All requirements must be documented, meaning that evidence of the correct fulfillments of tasks must be available. What documentation is relevant depends on the task and/or process/procedure/instruction requirements. No specific outputs are described in the NSA guidance's,

except that the evidence assured. Consequently, an organization can develop this in a way that fits their need.

It is though recommended that registration/archiving is not a general process, but linked to the specific process/procedure/instruction to ensure that safety relevant and non-safety relevant documentation is not acted on equally - this also ties into the Risk profile, where the link between hazards and barriers means that any failure of barrier as reported in incident/accident reports, could lead to changes to barriers.

5.2.1.6 Monitoring

It is required that the SMS is kept up to date for legal and external requirements. No specific outputs are described in the NSA guidance's, except that the validity of the SMS is monitored, and the SMS is updated if necessary. Consequently, an organization can develop this in a way that fits their need.

5.2.1.7 Planning

Planning of tasks are linked to the barriers and hazards identified in the Risk profile and the organizations Activities. Planning can cover anything where tasks need to be performed, from training, maintenance to certification.

5.2.1.8 Safety culture

On top of the Activities, it also needs to be considered what the goal, vision and purpose of the business is. On management level it must be ensured that these support a functional safety culture.

They key component of this part of the guidance, is that any business processes must not contradict safety processes and that the right resources are dedicated for implementation of the SMS and adjacent safety culture.
In addition, safety policies and communication paths/procedures must be established.

No specific outputs are described in the NSA guidance's, except that the SMS is followed, and a strong safety culture is assured. Consequently, an organization can develop this in a way that fits their need.

5.2.2 Interviews

Three interviews were conducted – details of the infrastructure managers can be seen in Table 6.

The interviews were transcribed and meaning condensation was performed – see Tools and theories for more information on the method. Due to a technical error the OL interview was only condensed – see Appendix 3 – Transcription and condensation of interviews and Source of errors for details on this. The meaning condensation is the basis for this section.

In the following sections, the condensation and the generalized results are shown thematically for the combined interviews.

Name	**Odense Letbane (OL)**	**Metro Service (MS)**	**Lokaltog (LT)**
Type	Light Rail	Metro	Conventional rail Regional
Respondent	Safety manager	Safety manager	Safety manager
Size	Small	Medium to large	Medium to large
Purpose	Passenger transport	Passenger transport	Passenger transport Own goods
Roles	Infrastructure manager and operator	Infrastructure manager and operator	Infrastructure manager and operator
Split SMS according to roles	No	No	No
Certification	BEK172	BEK172	BEK147
Other legislation	BEK1608	No	No
Start of operation/ company	2022	1998	2015 (in current format)
SMS integration	No	Yes (basis is QMS)	No
Interface	Office: Web Operation: App	Office: Web Operation: Paper (M2+M2) and tablet (M3+M4)	Platform/web. Partly paper-based, partly digital.

Format	Text-based approach (documents) on top of visual plan-do-check-act cycle	Mix of network processes and procedure instruction	Text-based approach combined with visual procedures and swim lanes
Configuration	Access control c.f. user group	Open	Open

Table 6 Details on infrastructure managers that was interviewed

5.2.2.1 Basis

OL and MS are certified in accordance with BEK172, while LT is certified in accordance with BEK147 and will be re-certified in accordance with BEK172 from approximately 2024. The choice to re-certify in accordance with BEK147 was based on wanting more time to implement the new requirements from BEK172 and CSM-SMS.

All respondents answered that their SMS was based on the legal requirements from the applicable executive order, and that it was kept as simple as possible in relation to the needs of the organization. But it was also generally agreed that the requirements meant that the SMS would have to occupy a certain amount of space no matter what, due to the overall set of requirements, and that it was rather the needs and activities of the organization that determined how large the size of the SMS would eventually be – see more on this in Format.

While it was not discussed in all interviews, OL highlighted that their SMS was fully based om a system description and the subsequent risk profile. It is assumed that the other infrastructure managers also have some sort of system description to base their risk profile on – indeed, MS confirmed that activities were the basis for the extent of the SMS, which supports this generalization.

LT highlighted that while the basis was the legal requirements, the secondary factor was user interface – see more on this in Format.

When asked what was difficult when building an SMS, MS noted that the risk profile itself could be difficult, as the actual implementation is more difficult than the theory suggests. Therefore it was often recycled from other infrastructure managers and slightly altered to fit the new infrastructure. The difficulty of the development of the risk profile was not directly discussed in the interview with

OL but establishing the link between the reporting and the development of the risk profile after the safety approval was discussed – see Traceability.

5.2.2.2 Integration versus separation

Whether the SMS is integrated with other management systems, differs. MS has an integrated system, where the basis for all management systems is the QMS. OL and LT has separated their systems.

MS views an integrated system as simpler for the end-user, as well as a better support for the business; as a SMS does not contain/support an organization but can be understood as a set of safety requirements. Instead QMS already contains parts of what is required to gain safety approval for the SMS, which in turn simplifies the system for the end user – it clearer for the user how and when to use it; to understand the use of it. An example of this is that an audit is the same no matter the input (rail safety, environment, quality, etc.) that triggered the need for the audit.
For MS, the SMS was built into the QMS from the start.

OL and LT has instead built a separate SMS's. OL has an entirely separate platform, where MS has a partially shared platform in the style of an intranet.
MS has chosen the partially shared platform (intranet) as a "lure", in order to familiarize and integrate the SMS in the daily workspace. This means that all procedures and processes are separated, but in order to access non-SMS functions the platform needs to be accessed. This approach was explained to be due to experience that integration has room for failure, as it is difficult to make a complex system simple – more complexity therefor makes it less simple. In addition if the SMS encompasses to much, the experience is that it gives a SMS where responsibility/procedures are split into many different areas instead of shown in a coherent manner, which is not user friendly.
In the interview with OL the reason for a completely separated system was not discussed. It should be noted that despite the systems being separated, OL and MS both mentioned that the same form (or process) should be used for the same task if possible, in order to keep the workflows simplified.

5.2.2.3 Format

The three SMSs were quite different, and the reason for the format choices also differed slightly. In the interview with LT it was emphasized that the SMS only works if it describes what is done and if what is done is described, and while it was not discussed explicitly, there was general agreement on

this. The difference in structure and format can instead probably be explained partially due to experience and partially due to different focus.

For LT, a text-based approach combined with visual procedures and swim lanes is used. In the swim lanes the procedure shows activities distributed on roles. Processes are mapped according to overall areas, and procedures, instructions, check forms, etc. is mapped within the procedures of the relevant area (infrastructure, traffic, materials, etc). The overall structure is a graphical build, where links are layered on images. A 3-click principle is used, to support ease of use. This was done based on an understanding that a system where things cannot be found or the system does not make sense, it is not used, and therefore does not work.
Further, the recent re-certification also meant that a transfer to a digital platform from a paper-based platform was made. Not all functions has been made digital yet, but it is the intent to migrate to a fully digital system. The reason to go completely digital was to make sure that the SMS was used in the operational end, simply by making it easier to access through tablets, etc.

At MS, a mix of network processes and procedure instruction is used, in a core and support process system. Since the QMS is the basis for the SMS, the QMS structure in accordance with the ISO:9100 certification has largely defined the SMS structure. Like LT, MS uses networks that are mapped into overall areas, with processes shown in swim lanes, where roles and actions are shown – the difference is that areas are divided into core and support, where LT does not differentiate between those as long as the SMS requires the process.

OL has a text-based approach where everything is managed as digital forms and documents. Visually the system is contained in a plan-do-check-act cycle, where the operational acts are grouped in overall areas (planning, traffic, rolling stock, infrastructure) in the do-cycle. There is no processes in visual format, but they are contained in documents.
Access to different parts of the SMS is through user configuration, meaning that only certain user groups can see certain content. The user configuration is based on the role/function of a person, e.g. a train driver can only see content that is relevant for his/her role.
Everything only exists digitally, meaning that for operational staff the access is through an app, where reports can be made, deviations can be submitted, and rules can be found, etc.

All three respondents had the following similarities, despite executing the SMS differently:

- There should only be one copy of anything that can be kept common.

    - While MS had more common approaches due to the integration with QMS, both OL and LT answered that a document/process/instructions/etc. only existed one place, and if it was necessary to have it more places the secondary location would be through links.
- An SMS must be user friendly, and therefore the user-interface must be designed (at least partly) by the end-user.
    - All respondents generally agreed that the format must support the use. Especially LT stressed the need to be able to tailor the system to the users, considering that the user often had a better understanding of what they performed. OL had developed the system to support easy use in the operational end, by adding an app-function for the operational staff – while this was argued in terms of better data quality, the end-result can be viewed as the same.
- The structure and format of the SMS must be thought through to end before execution.
    - Both OL and MS highlighted that any requirement needed to be reflected on and the structure/format of an SMS needed to be defined before executing it. Both respondents agreed that this ensured that it kept the amount of unintentional errors and failures to a minimum. MS also noted that requirements must add value, and therefore cannot be implemented without reflection.
- Data needs to be managed "smart"
    - Both OL and LT mentioned functions where tasks cannot be given to staff without the competence to do the task. In addition, OL highlighted that all data (through reports, etc.) are linked to technical/traffical systems, e.g. if you report a failure on rolling stock then the form only allows you to choose causes/equipment/etc. that are linked to the type of rolling stock.

      MS did note that having a tailored system requires either help or the right competences., but that the return outweighed the cost in the current setup.
- All requirements are equally important
    - An NSA approval cannot be given without all requirements being fulfilled, they cannot be differentiated. None of the actors had specific issues with the different requirement themselves, but more the format and implementation itself.
- Using a digital system is not necessarily a priority, but it does give added work.

- MS and LT are moving towards digital systems to avoid both double-work and to make the user-friendliness higher. In the interview with OL a paper-based approach was not directly discussed, but it is considered safe to deduce that a paper-based approach was not considered an option due to the considerations about data quality.

While it was not discussed in the interview with MS, for both LT and OL the traffical planning was managed separately from the SMS.

The big difference between the respondents, for the format, is mainly the use of processes versus instructions and text versus visualization. While their approach and focus can be considered slightly different, the use of common requirements means that it is the implementation rather than the activities that seem to create the major difference.

5.2.2.4 Traceability

Document control according to BEK172 and the NSA guidance's have a large set of obligatory traceability, and all respondents showed that this was integrated in the systems.

In the interview with OL, traceability was instead more focused on the link between data and risk profile. OL has built in traceability between operation (incident and accident reporting, as well as deviations) and the risk profile through the mitigation measures. This is done by connecting the data from the reporting to the hazards. Through the traceability of hazards to procedures/actions/incidents, it is possible to manage reporting and monitoring within the risk profile, i.e. if a hazard is triggered many times it can be seen in the risk profile, and it is possible to develop the mitigative measures to keep control of the risk. This is indicated through colour coding and arrows, that give a "live" picture of the trends.

It was stressed by all respondents, that all requirements are equally important, but OL highlighted that traceability between requirements and actions as well as mitigation is key. To keep control of the risk profile, through the system description, version control or change management in necessary.

5.2.2.5 Changes

All respondents use a change overview/log.

Logging and reporting of deviations, as well as the use of CSM-RA for non-deviation changes, are used to manage changes. For both MS and LT a process for change management is used to show compliance to the safety approval as well as the executive order is used in combination with the log. OL has the same overall approach, but due to the format of the SMS it is handled through an instruction and a log, with which the assessment of impact (according to CSM-RA) is also saved.

When asked what was difficult when building an SMS, MS noted that the basis-requirements in SMS requirements (training, registration, monitoring, etc.) for safety approval, are not in themselves difficult, but implementing methods on new areas and acquiring approvals (that are not in-house) for intermittent changes, with the associated paperwork/hours/money, requires more focus than the internal organization itself. This issue was partly described through a general need for time to implement ways to work that was not always available – both for content of SMS, but also for training and safety culture – and partly described through a need for new competences to manage the impact new requirements created – to incorporate and make the regulations "live" in the operation, a translating layer is needed to communicate the law into actual processes/instructions/etc. to the end-user.

When asked about management of third parties, OL noted that the format of the SMS meant that it was easy to share the requirements of the change process with the third parties. This was not discussed in the interviews with MS and LT, but from own experience it can be difficult to export an understanding from a process-views to third parties.

5.2.3 Sub-conclusion/learning points

The NSA guidance's sets a series of requirements to content and function, but not to the format itself. This means that it is largely up to the company to determine how to execute and implement the requirement as long as the content and function works in a satisfactory manner. Activities and risks are the basis for all further work, which means that competences/roles in regard to responsibilities and tasks needs to defined on the basis of the risk profile and activities.

Through interviews with three different infrastructure managers that has different sizes as well as different types of rail system, it was found that the best-case approach for managing requirements in the "basic" SMS did not majorly differ. While the methods and focus did differ a bit, e.g. MS works primarily from the CENELEC standard for changes where OL works primarily form the CSM-RA

approach for changes, the overall understanding of what actions/tasks and content was needed on the basis of the requirements was the same.
Instead the interviews highlighted that the execution of the SMS in terms of platform, types of system support and user interface differed majorly. This can potentially be explained on the different focus, as all the respondents was focused on different aspects of the SMS, but it was also highlighted through the interviews that the user interface was a high priority for the format. This inherently has the consequence that the format will differ across different organizations.

5.3 Research question 3

In this chapter the following research question shall be answered:

i. *How can a common-basis SMS be scaled for different infrastructure managers?*

This is answered by looking at the input from stakeholders working with SMS for infrastructure.

In Research question 1 it is made clear that, except for veteran trains, the requirements is the same for all infrastructure managers. Both MS and LT stated that the size of the SMS shall fit the needs of the organization. The size of the SMS can vary; the smaller the company, the simpler the SMS. But even for a large company, the SMS shall be kept simple – as far as possible.

LT noted that competence management is (more) difficult in a large organization with many roles and activities, compared to a small organization with a few persons, roles and activities. Normally competence management is done by making sure that functions and roles are cross-matched. A point in this interview was that a digital system can make competence management easier, as it can be programmed to restrict the potential of human error to give an assignment that requires a certain competence to someone who does not have a competence. In a small company, the competence management could be managed on paper (e.g. excel sheet) more easily, than in a large company. For the small company the excel sheet is maybe even easier, because it is unlikely that the clerk instead of the mechanic is asked to change a tire, and therefor it can be considered excess to create a digital system. Using the same example of changing a tire, in a large company with many types of vehicles and in the range of 100-500 employees, the likelihood of giving a task to someone that is not trained for the specific type of vehicle/task is greater.

The above suggest that while the SMS shall be kept as simple as possible no matter the size of the organization, the SMS requirements might create the same general size. Therefore the format should be considered to be the point of scaling for infrastructure managers.

LT notes that tailoring their digital system required that a competence was hired for the job. While outside tech support could have solved this need, it does create a longer time for solving a change.
It should also be noted that MS, which is a medium to large organization, has managed to work paper-based without major issues up until now.
This suggests that a small company, meaning a company with few roles/employees and few activities, should consider the benefit of working paper-based versus a large(r) company would probably benefit from working with a digital solution with a greater volume of traceability between different actions and requirements. This choice should though be considered carefully, as it can also be noted from the interviews that the smallest of the infrastructure managers have the most digital system, and it could further be argued that a well-thought-out digital system could minimize the cost of operation through a lesser need of staff due to easy data management.

5.3.1 Sub-conclusion/learning points

The scaling is not directly related to the SMS requirements themselves, but rather the format of the SMS in regard to the size and/or the amount of activities of the organization that needs to manage the requirements. While a paper-based system is valid and maybe the best choice for a small company, the return of easy data management should be considered

5.4 Draft blueprint

Based on Research question 1, Research question 2 and Research question 3 a draft blueprint is proposed as shown in Figure 7.

As also stated in Research question 2 the major difference between the respondents manifested in how the execution of the SMS was done in terms of platform, types of system support and user interface. Consequently, the draft blueprint is split into Overall approach and Format.

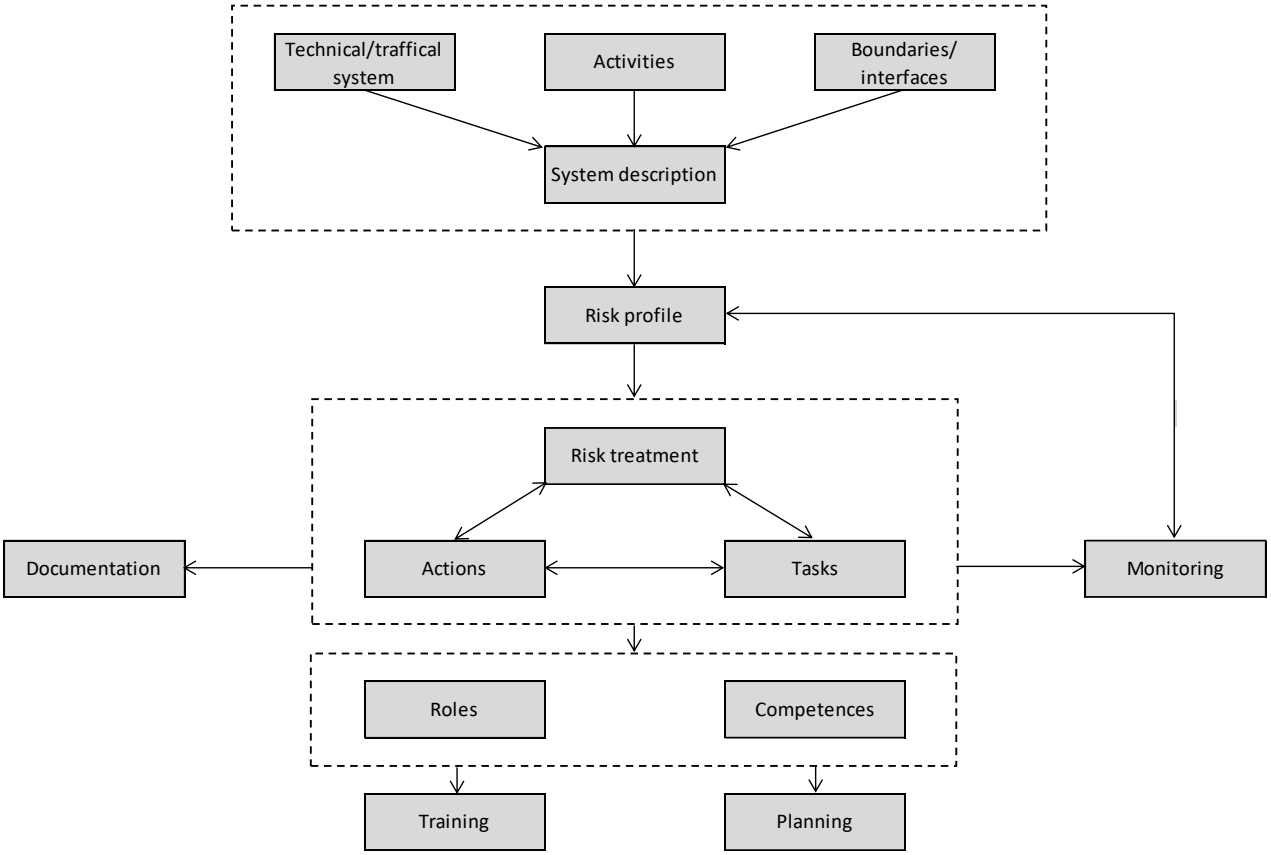


Figure 7 Visualization of draft blueprint approach

1.1.1 Overall approach

It is obvious that Figure 7 does not on surface deviate majorly from the NSA guidance's. This is considered overall in line with the fact that the requirements are common across different infrastructures.

Consequently, the resulting recommendations to the draft blueprint approach is:

- A generic mapping of activities and risk profile is performed.
    - Technical/traffical systems as well as boundaries/interfaces differ between different infrastructure managers, and therefor it is not recommended that a generic description is made, as this could mean that the immature actor could lean to heavily on descriptions that are not valid for the specific infrastructure.

    - The generic mapping of activities and risk profile cannot stand alone but shall be reviewed as a part of the work to describe the technical/traffical systems as well as boundaries/interfaces. The reason to map these two elements in a generic format, is partly to support infrastructure managers with a "help-list", but also to be able to frame the further actions in the approach (i.e. in order to develop a structure, some input is required) – see Format.
- *Risk treatment/actions/tasks* and subsequently *roles/competences* as well as *documentation* and *training/planning* relies entirely on the system description and risk profile. Therefor no generic input is given, but the content of the requirements for the specific infrastructure must be defined by the infrastructure manager.
    - The same guideline is valid for *monitoring*, but it is considered that a framework is needed for this function – se next bullet.
- In order to support data quality and ease of use, the framework for ensuring the link between the risk profile and the reporting – see Format.

While it has not been considered in detail, it is thought that the approach described above does not exclude the possibility to integrate the SMS with other management system.

1.1.2 Format

It shall be noted that in the interview with LT it was stated that a finished product for SMS should not be set in stone but be able to be tailored to the organization. Instead it was suggested that it would be more beneficial to develop a product consisting of different approaches depending on activities/size, where a company could pick the one that suited best could be used, but tailoring would still be necessary as no company is quite alike another.

While the interest of a blueprint framework was not directly discussed with either MS or OL, in the interview with MS the maturity of an organization was mentioned as a part of how conservative the safety culture should be. In this regard, LT noted that as a completely new actor a finalized frame would make more sense, than for an actor that is relatively mature and need to be able to tailor. While the two statements are not directly linked, it suggest that an immature organization generally need a more rigid framework OR more guidance to reach the needed solution, to avoid being either too conservative or not conservative enough.

Further, the level and extent of digitalization needs to be considered. The approach used in OL, where it is possible to manage reporting and monitoring within the risk, could potentially be beneficial for all types and sizes of companies. On the other hand, the interview with LT suggests that in very small companies, activities like competence management and planning in relation to activities could relatively easily be managed in a document form, which could be simpler and cheaper in the operational phase. This suggests that some elements needs to digitalized, while other

For the visual format of the SMS, the approach of the respondents differs between process versus instruction as well as text versus visual view. As the NSA has no direct requirements to this matter, it could be argued that all approaches should be an option in a common-basis approach.

Therefore it proposed that the common-basis SMS is differentiated based on the size, activities and needs of the organization. While the approach shown in Figure 7 shall be general, it is proposed to differentiate the tools used in the SMS functions, e.g. competency management, training, monitoring, etc., to ensure that the simplest solution is chosen based on the size of the infrastructure manager. Lastly, it is proposed that the SMS is a digital system which a web- an/or portal-based setup, where the user interface can be build according to the end-user preference, but to also give the option of paper-based functions.

Consequently, he resulting recommendations to the draft blueprint format is:

- A paper-based and a digital version is provided, where it is partly possible to mix the types. Some functions will only be provided digitally though.
    - The paper-based version contain templates. No paper-based template for risk profile, check forms, reporting and work-flows is provided. This is chosen to support data driven traceability between operations and hazards.
    - The digital version is built as a basic template(s), where some work will be required to add the data for the functions.
- It is made possible to work with both processes and instructions as the basis for procedures/actions.

While it has not been considered in detail, it is thought that the approach described above does not exclude the possibility to integrate the SMS with other management system. A digital solution might not be able to interact with a pre-existing digital solution.

It should be noted that the recommendations only cover some of the focus points that was highlighted in the interviews, as the blueprint product in a beta-type and/or final version would require fine-tuning to find the right level of variations, as well as it needs to be explored what type of solutions are possible – see also Future works.

6 DISCUSSION

The Draft blueprint is an outline that includes a set of recommendations. This means that further work is needed to fully grasp and assess the function of a common-basis approach – see also Future works. Despite this, there are some aspects that needs to be considered.

The problem with a common-basis approach is, at first glance, is not the requirements or indeed the execution of the requirements – the latter could be tailored to different levels depending on the company needs and wants. The challenge seems rather to be the difference in how an SMS is communicated and made easy to use for a specific company, which seems to have separate requirements and wishes for the interface and functions.

While this was not directly discussed in the interviews, it could be reasoned that the age of the safety system for MS, as well as the fact that the Metro was the first of its type of approval (until then conventional rail approvals were the only approved type), means that the format of the MS SMS is slightly different from LT and OL. LT, a company that is a merge of several companies in 2015, seems to have more similarities with OL, who is the newest infrastructure manager to gain an approval – and also the most digital and quantitatively focused for the link between reporting and risks. Therefor the discrepancies between format might not be entirely related to the users, but also to the way of working at the time of approval and the cost of major change in an established system. This theory could be further supported by interviewing more infrastructure managers, as well as potentially revisiting OL, LT and/or MS.

It should maybe instead be considered whether a more proactive approach should be taken, meaning that it should be considered if a common-basis approach should not look further than the existing requirements and existing best-case approach. In the interview with LT it is mentioned that changes and approvals are expensive, as well as time consuming and often difficult to navigate. Therefor LT has already employed non-traditional competences and started looking directly to ERA to understand what requirements are. This is not to say that other infrastructure managers have not done this as well, MS and OL included, this was just not discussed in those interviews.
An example of using a proactive approach would not only be to look into other business approaches, e.g. aviation, gas and oil, etc., but also to look into the overall European approach. As the legislation is (often) translated differently in a national context due to different understandings of the framework,

and since the framework is developed partly through the member state opinions, future requirements could be found within the business area of rail.

This is of course a somewhat risky approach, as it could mean implementation of non-necessary tools or opposites to future requirements. But considering the cost and time of implementation as well as changes, it should be considered if the return does not outweigh the cost.

6.1 Source of errors

While there is an inherent source of error for semi-structured interviews – as the same information is not necessarily gathered from all the interview because the structure allows for tangents – in relation to this task, there are primarily quality considerations in the information processing and in the methodological approach.

The quality requirement of the data should be considered in terms of transparency, validity and recognizability where it is usually considered in terms of reliability, validity and generalizability (Brinkmann & Tanggaard, 2015). Qualitative empirics cannot be contextualized to such an extent that repetition of the same results can be obtained as with reliability in an experiment - this does not exclude either generalization or contextuality, but just that one talks about two very different quality bars to be considered between quantitative and qualitative data.

Kvale & Brinkmann describes the primary problem of transcription as a change of form (Kvale & Brinkmann, 2014, s. 236) that betrays the original format – this is also true for the condensation. In the attempt to understand, one thus loses more information at each procedural intermediary until the theory / conclusion.

In the choice of treatment of the sound recordings, however, it was chosen to emphasize the narrative of the construct and finding trends and contexts in the data. Consequently, it was decided to cut the transcription down to sentence level with the omission of hesitation, duplicated words, non-sensical language, irrelevant nonverbal language and affirmative sounds.

However, there is a risk that the choice has led to data being misunderstood and thereby misinterpreted. Kvale and Brinkmann emphasize the concept of sentences as a problem for reliability (Kvale & Brinkmann, 2014, s. 244), which can be seen in several of the thesis transcripts - unless the respondent has been clear in his pauses and has generally spoken in sentences rather than fluent

speech, any transcription interprets the respondent's language and potentially create an unintentional interpretation.

In addition, the technical error that lead to the OL interview not being recorded, adds a further change potential source of error, as the condensation is purely made from memory of the interview – which at best can be considered faulty.

Lastly, because it has been a process where many sub-elements has been performed simultaneously, the seven phases of validation as described by Kvale & Brinkmann have not been well-thought-out (Kvale & Brinkmann, 2014, s. 320) and it important to call attention to, that the thematic considerations prior to the study has not been fully realized. This is partly explained through the inductive / abductive approach, meaning that the structure of the task has built in sources of error.

7 CONCLUSION

The following problem formulation has been investigated in this project:

Can a common-basis approach be used in order to assure operational safety management systems functions in accordance with legislative requirements across different infrastructure managers?

In order to answer the above problem, the following work questions were chosen:

iv. *What requirements is placed on safety management systems?*
v. *What is the best-case approach of managing the mapped requirements?*
vi. *How can a common-basis SMS be scaled for different infrastructure managers?*

The research questions gave the following input to the draft blueprint framework:

i. The main contributor of requirements are BEK172, which contains are broad range of requirements on the safety functions of an SMS – see also Figure 6. There is no difference between types of infrastructure in terms of legal requirements to SMS, as long as the activities remain the same.

ii. The NSA guidance's sets a series of requirements to content and function, but not to the format itself. This means that it is largely up to the company to determine how to execute and implement the requirement as long as the content and function works in a satisfactory manner. Activities and risks are the basis for all further work, which means that competences/roles in regard to responsibilities and tasks needs to defined on the basis of the risk profile and activities.

   Through interviews with three different infrastructure managers that has different sizes as well as different types of rail system, it was found that the best-case approach for managing requirements in the "basic" SMS did not majorly differ. While the methods and focus did differ a bit, e.g. MS works primarily from the CENELEC standard for changes where OL works primarily form the CSM-RA approach for changes, the overall understanding of what actions/tasks and content was needed on the basis of the requirements was the same.

iii. Instead the interviews highlighted that the execution of the SMS in terms of platform, types of system support and user interface differed majorly. This can potentially be explained on the different focus, as all the respondents was focused on different aspects of the SMS, but it was also highlighted through the interviews that the user interface was

a high priority for the format. This inherently has the consequence that the format will differ across different organizations.

iv. The scaling is not directly related to the SMS requirements themselves, but rather the format of the SMS in regard to the size and/or the amount of activities of the organization that needs to manage the requirements. It is suggested that a small company with few activities and few staff should work paper-based to avoid excess investment in digital systems, due to the relative ease of keeping up with the impact of changes on activities, risks and requirements, while a larger company with several activities and several staff should work more digitally due to a greater complexity. This choice should though be considered carefully, as it can also be noted from the interviews that the smallest of the infrastructure managers have the most digital system, and it could further be argued that a well-thought-out digital system could minimize the cost of operation through a lesser need of staff due to easy data management.

Based on the research questions, the draft blueprint framework was visualized in Figure 7 and the following recommendations was given:

- A structure, with a generic mapping of activities and generic risk profile is provided, in which the infrastructure manager must perform as series of activities to define the SMS content. This does not differ largely from the existing approach. This also means that a template for the risk profile is provided.
- The format is largely variable and can be tailored as well as scaled according to the need of the organization. This is managed by having templated approaches, where a paper-based or digital solution can be chosen. Some functions are not variable, for example traceability settings between risk profile and reporting are only templated digitally, in order to support ease of use and the activities related to monitoring. Only functions which are deemed to add value in a digital format are not variable.

It can therefore be concluded that a common-basis approach is possible to create and can be used in order to assure operational safety management systems functions in accordance with legislative requirements across different infrastructure managers – at least to some degree. The basic activities required to form a SMS can be unified, due to the common requirements, and a generic principle does have potential to be useful. On the other hand, a common-basis approach must be able to contain differing sized, needs and wishes from the user end, and a completely unified approach is not

recommended. Indeed, the purpose of giving the infrastructure manager the responsibility of showing compliance to the requirements, would be defeated by an entirely unified approach, and it could be argued that it would create less safety in the system(s).

7.1 Future works

The draft blueprint framework only contains an outline of a common-basis SMS. Based on the recommendations, the blueprint approach should be developed to contain the mapping of activities, generic risk profile, tools for competences and so forth.

Following this, in order to tackle the sources of errors as well as the function of the recommended approach, the common-basis SMS should then be assured by performing verification of the function and feasibility of the draft blueprint framework.

In addition, the benefit and/or disadvantage of having an integrated versus a separate SMS from the remainder of management systems (QMS, electrical safety, etc.) should be further investigated. This thesis is focused on the SMS in the draft blueprint, and therefore it is not clear if integration into another framework can add value to the draft blueprint.

BIBLIOGRAPHY

Arpansa. (2022, March 17). *arpansa.gov.au*. Retrieved from arpansa.gov.au/regulation-and-licensing/safety-security-transport/holistic-safety/history: (https://www.arpansa.gov.au/regulation-and-licensing/safety-security-transport/holistic-safety/history

BEK711. (2020, May 20). BEK nr 711 af 20/05/2020.

BEK712. (2020, May 20). BEK nr. 712 af 20/05/2020.

Brinkmann, S., & Tanggaard, L. (2015). Kvalitet i kvalitative metoder. In S. Brinkmann, & L. Tanggaard, *Kvalitativ metode - en grundbog* (pp. 489-499). Hans Reitzels Forlag.

Christensen, L. B. (2015). Den frygteligste jærnbaneulykke. In L. B. Christensen, & m.fl., *Jernbanehistorie. Jernbanernes teknologi - og kulturhistorie* (pp. pp4-25). Dansk Jernbanemuseum.

CSM-RA. (2020, Ocotber 23). Consolidated text: Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety .

DSB. (2022, April 20). *https://www.dsb.dk*. Retrieved from https://www.dsb.dk: https://www.dsb.dk/rejsende/pendler/pendlerklubber/

DST. (2022, April 20). *https://www.dst.dk*. Retrieved from https://www.dst.dk: https://www.dst.dk/da/Statistik/nyheder-analyser-publ/nyt/NytHtml?cid=31869

ERA. (2022, April 20). *https://www.era.europa.eu/*. Retrieved from https://www.era.europa.eu/: https://www.era.europa.eu/agency/mission-vision-and-values_en

Havarikommissionen. (2022, April 21). *https://havarikommissionen.dk/jernbanearkiv/*. Retrieved from https://havarikommissionen.dk/jernbanearkiv/: https://havarikommissionen.dk/jernbanearkiv/

ISO:31000. (2018). *ISO:31000.* Geneva: ISO.

Kvale, S., & Brinkmann, S. (2014). *Interview - det kvalitative forskningsinterview som håndværk.* Hans Reitzels Forlag.

Lindahall. (2022, March 17). *railroad.lindahall.org*. Retrieved from railroad.lindahall.org/essays/locomotives.html: https://railroad.lindahall.org/essays/locomotives.html

LOV nr 686 af 27/05/2015. (2015, May 27). LOV nr 686 af 27/05/2015 (Gældende). Transport- og Boligministeriet.

Metroen. (2022, April 20). *https://m.dk*. Retrieved from https://m.dk: https://m.dk/om-metroen/metroen-i-tal/

Teknologihistorie. (2022, March 17). *teknologihistorie.systime.dk*. Retrieved from teknologihistorie.systime.dk/?id=163: https://teknologihistorie.systime.dk/?id=163

Trafikstyrelsen. (2020). *Vejledning i Sikkerhedsledelse.* Trafikstyrelsen.

Trafikstyrelsen. (2021). *Fakta ark 2020.*

Trafikstyrelsen. (2021). *Sikkerhedsrapport for jernbanen 2020.*

Trafikstyrelsen. (2022, March 17). *trafikstyrelsen.dk*. Retrieved from trafikstyrelsen.dk/da/Jernbanesikkerhed/Ansoeg-om-godkendelse-og-tilladelse/Introduktion-til-sikkerhedsledelsessystem#indledning: https://www.trafikstyrelsen.dk/da/Jernbanesikkerhed/Ansoeg-om-godkendelse-og-tilladelse/Introduktion-til-sikkerhedsledelsessystem#indledning

Aarhus Letbane. (2022, April 20). *https://www.letbanen.dk*. Retrieved from https://www.letbanen.dk: https://www.letbanen.dk/nyheder/nyheder/2020/letbanens-passagertal/

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APPENDIX

Appendix 1 – Mapping, part 1

The appendix contains the mapping of legislation basis, performed for mapping the requirements according to the section Research question 1.

Title	Date	Type	No.	Description
Jernbanelov - LOV nr 686 af 27/05/2015	27-05-2015	Law	686	Establishes the framework for rail transport, including ensuring that rail transport is organized and implemented with regard to safety, accessibility and good economy. The framework of the law complements and implements acts laid down by the European Union.
DIRECTIVE 2004/49/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 April 2004	29-04-2004	Directive	49	On safety on the Community's railways and amending Council Directive 95/18/EC on the licensing of railway undertakings and Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification (Railway Safety Directive).

COMMISSION IMPLEMENTING REGULATION (EU) No 88/2014 of 31 January 2014	31-01-2014	Directive	88	Adding CSI safety targets to Directive 2004/49/EC
ANNEX I OF DIRECTIVE 2004/49/EC AS AMENDED BY DIRECTIVE 2014/88/EU	21-05-2015	Guidance		Implementation Guidance on CSIs (https://www.era.europa.eu/sites/default/files/activities/docs/implementation_guidance_for_csis_en.pdf)
Bekendtgørelse 711 om ibrugtagningstilladelse for delsystemer i jernbaneinfrastruktur	20-05-2020	BEK	711	Establishes rules for the approval and procedures for the application for commissioning authorizations for railway infrastructure and for the application for authorizations for testing of railway infrastructure
Bekendtgørelse 710 om godkendelse af køretøjer på jernbaneområdet	20-05-2020	BEK	710	Establishes rules for the approval of vehicles in the railway area
Bekendtgørelse 543 om godkendelse af assessorer og sagkyndige i forbindelse med godkendelse af jernbaneinfrastruktur og køretøjer	24-05-2017	BEK	543	Approval of assessors and experts in connection with the approval of railway infrastructure and vehicles for type A, B and C accreditation in relation for ISO17020
Bekendtgørelse 1465 om køretøjers tekniske kompatibilitet med jernbanenettet	05-12-2016	BEK	1465	Establishes rules on technical compatibility requirements for rolling stock on the Danish railway

Bekendtgørelse 542 Krav til akkreditering af assessorer på jernbaneområdet	24-05-2017	BEK	542	Establishes rules on approval of assessors and experts in connection with the approval of railway infrastructure and vehicles for type A, B and C accreditation in relation for ISO17020
COMMISSION DELEGATED REGULATION (EU) 2018/762 of 8 March 2018	08.03.2018	Directive	762	Establishes common safety methods on safety management system requirements pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulations (EU) No 1158/2010 and (EU) No 1169/2010. *Implemented in BEK712*
Bekendtgørelse 712 om sikkerhedsgodkendelse, EU-sikkerhedscertifikat og sikkerhedscertifikat på jernbaneområdet	20-05-2020	BEK	712	Implements Directive 2018/762. Establishes rules on safety approvals, safety certificates and, to the extent that they are not regulated in regulations, EU safety certificates in the field of railways.
Bekendtgørelse 713 om interoperabilitet i jernbanesystemet	20-05-2020	BEK	713	Implements Directive 2016/797 / EU of the European Parliament and of the Council of 11 May 2016 on the interoperability of the railway system in the European Union.

Vejledning i Sikkerhedsledelse	19-06-2020	Guidance		Guidance in safety management cf. BEK712 (https://www.trafikstyrelsen.dk/da/-/media/TBST-DA/Jernbanesikkerhed/Publikationer/Vejledning-i-Sikkerhedsledelse.pdf)
Introduktion til sikkerhedsledelsessystem	-	Guidance (webpage)		Guidance to safety management system, continuously updated (https://tbst.dk/da/Jernbanesikkerhed/Ansoeg-om-godkendelse-og-tilladelse/Introduktion-til-sikkerhedsledelsessystem#indledning)
COMMISSION IMPLEMENTING REGULATION (EU) No 402/2013 of 30 April 2013	30-04-2013	Directive	402	European regulation on common safety methodology for risk assessment and assessment
COMMISSION IMPLEMENTING REGULATION (EU) 2015/1136 of 13 July 2015	13-07-2015	Directive	1136	Addition to Directive 402/2013 adding c.f. risk acceptance criteria and construction targets
ERA/GUI/01-2008/SAF	06-01-2009	Guidance		Guide for the application of the Commission Regulation on the adoption of a common safety method on risk evaluation and assessment as referred to in Article 6(3)(a) of the Railway Safety Directive

Vejledning om godkendelse af køretøjer på jernbaneområdet	08-10-2015	Guidance		Assist the applicant in applying for type approval, commissioning permit or permit for testing and / or transport. (https://www.trafikstyrelsen.dk/da/-/media/TBST-DA/Jernbanesikkerhed/Publikationer/Vejledning-om-godkendelse-af-køretøjer-på-jernbaneområdet.pdf)
Vejledning om godkendelse af letbaner efter jernbaneloven	24-05-2017	Guidance		how Danish light rail must be approved in accordance with the Railways Act. Initially, information is provided on approvals in the road area in accordance with the Roads Act and the Traffic Act. (https://www.trafikstyrelsen.dk/da/-/media/TBST-DA/Jernbanesikkerhed/Publikationer/Vejledning-om-godkendelse-af-letbaner-efter-jernbaneloven.pdf)
Vejledning om godkendelse af systemer med software på jernbanen	28-02-2016	Guidance		Support the executive orders on commissioning permits for subsystems in the infrastructure and approval of vehicles with associated guidelines, and relate to systems with SW

				(https://tbst.dk/da/-/media/TBST-DA/Jernbanesikkerhed/Publikationer/Vejledning-om-godkendelse-af-systemer-med-software.pdf)
Vejledning om risikovurdering - grundlæggende led i en risikovurderingsproces	19-12-2016	Guidance		Provides an introduction to the key concepts and basic elements of a risk assessment process.) (https://www.trafikstyrelsen.dk/da/-/media/TBST-DA/Jernbanesikkerhed/Publikationer/Introduktion-til-risikovurdering.pdf)
Vejledning om godkendelse af assessorer og sagkyndige	24-05-2017	Guidance		Guides companies on the requirements for being approved as an assessor and expert in connection with the approval of railway infrastructure and vehicles in accordance with Executive Order no. 654. (https://www.trafikstyrelsen.dk/da/-/media/TBST-DA/Jernbanesikkerhed/Publikationer/Vejledning-om-godkendelse-af-assessorer.pdf)

Vejledning om brug af assessor	26-05-2014	Guidance		The Danish Transport Authority's guidelines for using an assessor in accordance with the CSM regulation (https://www.trafikstyrelsen.dk/da/-/media/TBST-DA/Jernbanesikkerhed/Publikationer/Vejledning-om-brug-af-assesorer.pdf)
Vejledning om kompetencekrav ved CSM assessment	15-05-2014	Guidance		States the level and practice the Danish Transport Authority wants when determining the specific competence criteria for staff who employ themselves with assessment (https://tbst.dk/da/-/media/TBST-DA/Jernbanesikkerhed/Publikationer/Kompetencekrav-ved-CSM-Assessment.pdf)
Common Safety Method for risk evaluation and assessment - Guidance on the application of Commission Regulation (EU) 402/2013	01-03-2015	Guidance		This guidance summarises and explains the main requirements of the CSM RA, to whom it applies, and specific points on compliance in the UK (http://orr.gov.uk/__data/assets/pdf_file/0006/3867/common_safety_method_guidance.pdf)

EN50126-1:2017	17-10-2017	Standard		Railway applications. The specification and demonstration of reliability, availability, maintainability and safety (RAMS). Basic requirements and generic process. Part 1 Generic RAMS Process
EN50126-2:2017	17-10-2017	Standard		Railway applications. The specification and demonstration of reliability, availability, maintainability and safety (RAMS). Basic requirements and generic process. Part 2: Systems Approach to Safety
EN50128:2011	21-07-2011	Standard		Railway applications. Communication, signalling and processing systems
EN50129:2003	07-05-2003	Standard		Railway applications. Communication, signalling and processing systems. Safety related electronic systems for signalling
ISO 17020 Overensstemmelsesvurdering	21-05-2012	Standard		Requirements for accreditation system for Assessment Body

Appendix 2 – Mapping, part 2

The appendix contains the mapping of requirements according to the section Research question 1.

Type of rail					**Requirement**		
City			**Conventional**		Section	Subsection	Text
Metro	S-bane	Light rail	Public	Farligt gods	*Section is given here*	*If applicable, subsection is given here*	*Text from reference*
Yes = X No= do not fill	*Yes = X No= do not fill*	*Yes = X No= do not fill*	*Yes = X No= do not fill*	*Yes = X No= do not fill*			
BEK nr. 712 af 20/05/2020							
			x		§3	Stk. 1	Trafik-, Bygge- og Boligstyrelsen udsteder sikkerhedsgodkendelse til infrastrukturforvaltere, der er omfattet af direktiv 2016/798/EU om jernbanesikkerhed, hvis virksomheden har implementeret et sikkerhedsledelsessystem, som opfylder kravene i Kommissionens delegerede forordning (EU) 2018/762 af 8. marts 2018 om fastlæggelse af fælles sikkerhedsmetoder vedrørende krav til sikkerhedsledelsessystemer.
x	x	x			§3	Stk. 2	Trafik-, Bygge- og Boligstyrelsen udsteder sikkerhedsgodkendelse til infrastrukturforvaltere, jf. jernbanelovens § 39 a (bybaner), og sikkerhedscertifikat til jernbanevirksomheder, jf. jernbanelovens § 39 (bybaner), hvis virksomheden har implementeret et sikkerhedsledelsessystem, som opfylder kravene i bilaget.

x	x	x	x		§4	Stk. 2	Sikkerhedsgodkendelsen, jf. § 3, stk. 2, og sikkerhedscertifikatet er gyldig(t) i op til 5 år efter udstedelsen med de ændringer, der måtte følge af lovgivningen.
x	x	x	x		§5	Stk. 1	Trafik-, Bygge- og Boligstyrelsen kan fastsætte vilkår i sikkerhedsgodkendelsen og sikkerhedscertifikatet.
x	x	x	x		§6	Stk. 1	Virksomhederne har ansvaret for en sikker drift af deres del af jernbanesystemet og kontrollen med de risici, der opstår på dette system, herunder, når det er relevant og rimeligt, også risici, som er en følge af andre parters aktiviteter.
x	x	x	x		§6	Stk. 2	Virksomhederne har pligt til at iværksætte nødvendige risikostyringsforanstaltninger, og hvor det er relevant, at inddrage og samarbejde med de øvrige parter på jernbaneområdet omkring disse foranstaltninger.
x	x	x	x		§7	Stk. 2	Jernbanevirksomheder, der er omfattet af direktiv 2016/798/EU om jernbanesikkerhed, herunder virksomheder, som er certificeret i henhold til jernbanelovens § 11, fremlægger i forbindelse med underretningen efter stk. 1 en oversigt over personalekategorier og køretøjstyper.
x	x	x	x		§9	Stk. 1	Ansøgning om sikkerhedsgodkendelse og sikkerhedscertifikat skal indsendes på dansk eller engelsk.
x	x	x	x		§13	Stk. 1	Infrastrukturforvaltere og jernbanevirksomheder, jf. jernbanelovens § 39, skal underrette Trafik-, Bygge- og Boligstyrelsen, hvis der sker ændringer i virksomhedens navn, adresse eller juridiske status.

x	x	x	x		§13	Stk. 2	Infrastrukturforvaltere, der er omfattet af direktiv 2016/798/EU om jernbanesikkerhed, skal omgående underrette Trafik-, Bygge- og Boligstyrelsen, hvis der er væsentlige ændringer i delsystemerne for infrastruktur, signaludstyr eller energi eller i principperne for deres drift og vedligeholdelse.
x	x	x	x		§13	Stk. 3	Infrastrukturforvaltere, jf. jernbanelovens § 39 a, og jernbanevirksomheder, jf. jernbanelovens § 39, skal omgående underrette Trafik-, Bygge- og Boligstyrelsen, hvis: 1) Der er væsentlige ændringer i virksomhedens størrelse. 2) Virksomheden har til hensigt at ændre omfanget af sine aktiviteter væsentligt. BEK nr 712 af 20/05/2020 2 3) Der i øvrigt er væsentlige ændringer i forudsætningerne for sikkerhedsgodkendelsen eller sikkerheds-certifikatet.
x	x	x	x		§14	Stk. 1	Fornyelse af en sikkerhedsgodkendelse eller et sikkerhedscertifikat skal finde sted mindst hvert femte år, jf. også § 4.

x	x	x	x		§18	Stk. 1	Jernbanevirksomheder, infrastrukturforvaltere og virksomheder, som er certificeret i henhold til jernbanelovens § 11, skal hvert år inden den 31. maj sende en sikkerhedsrapport omhandlende det foregående kalenderår til Trafik-, Bygge- og Boligstyrelsen. Sikkerhedsrapporten skal indeholde: 1) oplysninger om, i hvilket omfang organisationens samlede sikkerhedsmål er nået, og om resultaterne af handlingsplaner, 2) en beskrivelse af udviklingen i nationale sikkerhedsindikatorer og udviklingen i fælles sikkerhedsindikatorer, som er fastsat i gældende EU-regler, og som Trafik-, Bygge- og Boligstyrelsen har vurderet at være relevante for virksomheden, 3) resultaterne af intern audit, og 4) bemærkninger om fejl og mangler ved jernbanedriften, som kan være relevante for sikkerhedsmyndigheden.
x	x	x	x		§18	Stk. 2	For jernbanevirksomheder, der er omfattet af direktiv 2016/798/EU om jernbanesikkerhed, herunder virksomheder, som er certificeret i henhold til jernbanelovens § 11, og infrastrukturforvaltere, der er omfattet af direktiv 2016/798/EU om jernbanesikkerhed, skal sikkerhedsrapporten, udover de oplysninger, der er nævnt i stk. 1, også indeholde en rapport om anvendelsen af de relevante fælles sikkerhedsmetoder.
LOV nr 686 af 27/05/2015 inkl. LOV nr 510 af 01/05/2019 (ændring af LOV nr. 686)							

x	x	x	x	x	§9	Stk. 1	Drift af jernbanevirksomhed i Danmark kræver tilladelse, der udstedes af Trafikstyrelsen. Trafik-styrelsen kan suspendere, ændre eller tilbagekalde tilladelser, der er udstedt til jernbanevirksomhederne.
x	x	x	x	x	§9	Stk. 3	Tilladelser udstedt af andre medlemsstater i Den Europæiske Union i medfør af EU-regler gælder i Danmark.
x	x	x	x	x	§19	Stk. 1	Infrastrukturforvalteren offentliggør sine krav til færdsel på baneafsnit, som denne forvalter.
x	x	x	x	x	§19	Stk. 2	Infrastrukturforvalteren skal stille de tekniske forskrifter, der er nødvendige for kørslen på et baneafsnit, til rådighed for jernbanevirksomhederne.
x	x	x	x	x	§23	Stk. 1	Infrastrukturforvalteren har ansvaret for en sikker trafikstyring på den del af jernbaneinfrastrukturen, som denne forvalter.
x	x	x	x	x	§23	Stk. 2	Ønsker en infrastrukturforvalter, at ansvaret for trafikstyringen skal varetages af en anden virksomhed, skal Trafikstyrelsen godkende dette. Trafikstyrelsen kan fastsætte vilkår herfor.
x	x	x	x	x	§24	Stk. 1	Der kan ikke uden tilladelse fra infrastrukturforvalteren 1) foretages udgravninger eller opfyldninger eller anbringes materiel eller materialer i en sådan nærhed af infrastrukturforvalterens område, at der derved kan opstå fare for driften, 2) føres ledninger over, under eller langs med banen, 3) ledes vand til banen eller dennes grøfter, herunder ved opstemning, eller 4) foretages arbejder i niveauoverkørsler.

x	x	x	x	x	§25	Stk. 1	Infrastrukturforvalteren kan kræve træer og anden beplantning på, over og ved baneareal fjernet, nedskåret, opstammet eller studset, når banens vedligehold eller hensynet til togdriften gør det nødvendigt. Efterkommes infrastrukturforvalterens krav ikke inden for en fastsat frist, kan infrastrukturforvalte-ren lade arbejdet udføre på ejerens bekostning.
x	x	x	x	x	§26	Stk. 1	Inden for nærmere angivne afstande, der fastsættes af transportministeren, jf. stk. 3, skal rummet over og på begge sider af alle spor, der ligger på havneområde uden at være bestemt afgrænset fra dette, samt alle spor, der ligger i vej, gade eller plads, der er åben for almindelig færdsel, holdes fri for faste og løse genstande.
x	x	x	x	x	§26	Stk. 2	§ 24 gælder tilsvarende for de spor, der er nævnt i stk. 1.
x	x	x	x	x	§27	Stk. 1	Infrastrukturforvalteren etablerer, vedligeholder og nedtager egne hegn, herunder fastsætter hegnstyper, på baneafsnit, der forvaltes af den pågældende.
x	x	x			§39 a	Stk. 1	Infrastrukturforvaltere, som forvalter infrastruktur på en bybane skal have en sikkerhedsgodkendelse, der udstedes af Trafik-, Bygge- og Boligstyrelsen.
x	x	x			§39 b	Stk. 1	Det kræver godkendelse fra Trafik-, Bygge- og Boligstyrelsen at tage jernbaneinfrastruktur eller køretøjer i brug på en bybane.
x	x	x			§39 b	Stk. 2	Trafik-, Bygge- og Boligstyrelsen kan udstede typegodkendelse til køretøjer efter stk. 1.
x	x	x			§39 c	Stk. 1	Transport-, bygnings- og boligministeren fastsætter særlige regler om bybaner, herunder beløbsstørrelser for ansvarsforsikring, indberetning af

							ulykker og hændelser m.v., kørestrøm, drifts- og trafikstyringsregler, tekniske krav og helbreds- og kompetencekrav for bybaneførere.
					§40	Stk. 1	Drift af veteranbaner samt udførelse af veterantogskørsel kræver tilladelse fra Trafikstyrelsen.
					§40	Stk. 4	§§ 48, 62 og 63 gælder tilsvarende for niveauoverkørsler på veteranbanerne.
					§40	Stk. 5	§ 81 gælder tilsvarende i det tilfælde, hvor der udføres veterantogskørsel på det åbne jernbanenet.
x	x	x	x	x	§41	Stk. 1	Infrastrukturforvalterens og jernbanevirksomhedens område omfatter stationsområder, banelinjer med tilhørende skråninger, banketter og grøfter, broer, tunneler, højbaner, arbejdspladser og andre anlæg, tog og andre køretøjer og forpladser og adgangsveje til stationer og jernbanefærgesteder, hvor disse ejes af jernbanevirksomheden eller ejes eller forvaltes af infrastrukturforvalteren.
x	x	x	x	x	§42	Stk. 1	Enhver, der søger adgang til eller opholder sig på de områder, der er nævnt i § 41, og som er åbne for offentligheden, skal rette sig efter de forskrifter til opretholdelse af orden og sikkerhed, der meddeles af virksomhedens personale, eller som ved opslag eller på anden hensigtsmæssig måde er bekendtgjort af virksomheden.
x	x	x	x	x	§44	Stk. 1	Reklamer og andre indretninger må ikke være anbragt således, at de er til ulempe for opfattelsen af signaler på banearealet.

x	x	x	x	x	§47 a	Stk. 1	Personer, der skal passere en perronovergang i niveau med jernbaneskinner, skal udvise særlig forsigtighed. Når sporene passeres, skal dette ske uden unødigt ophold. Stk. 2. Personer må ikke passere en perronovergang i niveau med jernbaneskinner i følgende situationer: 1) Det kan ses eller høres, at tog nærmer sig. 2) Advarsel om, at tog nærmer sig, er tilkendegivet ved signalanlæg. 3) Jernbanens personale tilkendegiver, at tog nærmer sig.
x	x	x	x	x	§48	Stk. 1	Ved passage af niveauoverkørsler, der ikke er åbne for almindelig færdsel, skal der udvises særlig forsigtighed.
x	x	x	x	x	§48	Stk. 2	Uvedkommende må ikke benytte niveauoverkørsler, der ikke er åbne for almindelig færdsel.
				x	§54	Stk. 1	Transportministeren kan fastsætte regler om transport af farligt gods på jernbaneområdet, herunder om virksomhedernes indberetninger om forhold vedrørende farligt gods. Transportministeren kan endvidere fastsætte regler om afsenders erstatningsansvar over for jernbanevirksomheden, såfremt der ved indlevering af gods afgives urigtig, unøjagtig eller ufuldstændig betegnelse eller der sker overtrædelse af gældende sikkerhedsforskrifter.
x	x	x	x	x	§57	Stk. 1	Jernbanevirksomheder og infrastrukturforvaltere er ansvarlige for sikkerheden på deres respektive del af jernbanesystemet.

					§57	Stk. 2	Andre aktører end dem, der er nævnt i stk. 1, og som har potentiel indflydelse på sikker drift af jernbanesystemet, herunder fabrikanter, vedligeholdelsesvirksomheder, ihændehavere m.v., skal 1) iværksætte de nødvendige risikostyringsforanstaltninger om nødvendigt i samarbejde med andre aktører, 2) sørge for, at delsystemer, øvrigt udstyr, materiel eller tjenesteydelser, som de leverer, opfylder de anførte krav og betingelser, således at det er sikkert for den pågældende jernbanevirksomhed eller infrastrukturforvalter at anvende det i driften, 3) træffe de nødvendige korrigerende foranstaltninger, hvis de inden for deres respektive kompetenceområder konstaterer eller underrettes om en sikkerhedsrisiko i forbindelse med mangler og konstruktionsmæssige fejl eller funktionsfejl ved teknisk udstyr, herunder også i strukturelt definerede delsystemer, med henblik på at udbedre den konstaterede sikkerhedsrisiko og 4) underrette de relevante involverede parter om risikoen, hvis de inden for deres respektive kompetenceområder konstaterer eller underrettes om en sikkerhedsrisiko i forbindelse med mangler og konstruktionsmæssige fejl eller funktionsfejl ved teknisk udstyr, herunder også i strukturelt definerede delsystemer, med henblik på at sætte disse parter i stand til at træffe de nødvendige korrigerende foranstaltninger, som sikrer, at sikkerhedskrav til jernbanesystemet er opfyldt.
x	x	x	x	x			

x	x	x	x	x	§57	Stk. 3	Infrastrukturforvalteren er ansvarlig for jernbanesikkerheden i niveauoverkørsler med de anlæg, der er nødvendige til sikring af vejtrafikken.
x	x	x	x	x	§59	Stk. 1	Infrastrukturforvaltere skal have en sikkerhedsgodkendelse, der udstedes af Trafikstyrelsen.
x	x	x	x	x	§60	Stk. 1	Det kræver køretøjsomsætningstilladelse at bringe et køretøj i omsætning i Danmark.
x	x	x	x	x	§60	Stk. 2	Typegodkendelse er en betingelse for køretøjsomsætningstilladelsen. Typegodkendelsen skal udstedes senest samtidig med udstedelse af køretøjsomsætningstilladelsen.
x	x	x	x	x	§60	Stk. 3	Køretøjsomsætningstilladelsen og typegodkendelsen udstedes af agenturet, hvis køretøjet skal have anvendelsesområde i mere end én medlemsstat i EU.
x	x	x	x	x	§60	Stk. 4	Køretøjsomsætningstilladelsen og typegodkendelsen udstedes af agenturet eller Trafik-, Bygge- og Boligstyrelsen i de tilfælde, hvor køretøjet alene skal have anvendelsesområde i Danmark.
x	x	x	x	x	§60 a	Stk. 1	Det kræver godkendelse fra Trafik-, Bygge- og Boligstyrelsen at tage jernbaneinfrastruktur i brug på det danske jernbanenet.
			x		§60 a	Stk. 2	Den, der udsender et udbud vedrørende fast ERTMS-udstyr (udstyr i forbindelse med det fælles harmoniserede togkontrolsystem), skal før udbuddet ansøge om agenturets godkendelse af, at de tekniske løsninger, der

							påtænkes, er i fuld overensstemmelse med de relevante tekniske specifikationer for interoperabilitet, jf. dog stk. 2 og 3.
x	x	x	x	x	§61	Stk. 1	Trafik-, Bygge- og Boligstyrelsen godkender de sikkerhedsregler, herunder trafikale sikkerhedsregler, som infrastrukturforvaltere udarbejder, jf. dog stk. 3.
x	x	x	x	x		Stk. 2	Trafik-, Bygge- og Boligstyrelsen godkender jernbanevirksomheders trafikale sikkerhedsregler, jf. dog stk. 3.
x	x	x	x	x	§61	Stk. 3	Infrastrukturforvaltere kan udarbejde og ændre egne sikkerhedsregler, herunder trafikale sikkerhedsregler, i henhold til virksomhedens sikkerhedsledelsessystem uden Trafik-, Bygge- og Boligstyrelsens godkendelse, hvis de krav, der er fastsat i medfør af stk. 4, er opfyldt. Tilsvarende gælder for jernbanevirksomheder i forbindelse med udarbejdelse og ændring af trafikale sikkerhedsregler.
x	x	x	x	x	§61	Stk. 4	Trafik-, Bygge- og Boligstyrelsen fastsætter regler om, hvilke krav infrastrukturforvaltere og jernbanevirksomheder skal opfylde, for at de kan udarbejde og ændre sikkerhedsregler, herunder trafikale sikkerhedsregler, i henhold til deres sikkerhedsledelsessystem uden Trafik-, Bygge- og Boligstyrelsens godkendelse, herunder regler om krav om brug af en uafhængig tredjeparts vurdering i forbindelse med udarbejdelse og ændringer af sikkerhedsregler, herunder trafikale sikkerhedsregler.

x	x	x	x	x	§62	Stk. 1	Udgifter til drift og vedligeholdelse af anlæg til sikring af vejtrafikken i niveauoverkørsler, der er åbne for almindelig færdsel, afholdes af infrastrukturforvalteren.
x	x	x	x	x	§63	Stk. 1	Anlæg til sikring af vejtrafikken i niveauoverkørsler, der ikke er åbne for almindelig færdsel, etableres og vedligeholdes af infrastrukturforvalteren for det pågældende baneafsnit.
x	x	x	x	x	§64	Stk. 1	Trafikstyrelsen kan kræve, at jernbanevirksomheder eller infrastrukturforvaltere, der ansøger om godkendelse af køretøjer, jernbaneinfrastruktur eller sikkerhedsregler, jf. §§ 39 b, 60, 60 a og 61, skal bruge en uafhængig tredjeparts vurdering i forbindelse med ansøgning om godkendelsen.
x	x	x	x	x	§65	Stk. 1	Den, som udfører sikkerhedsklassificerede funktioner på jernbaneområdet, skal have 1) opnået nødvendige faglige kvalifikationer via en uddannelse, der er godkendt af Trafikstyrelsen, jf. § 66, og 2) en helbredsgodkendelse, jf. § 68 (Transportministeren kan fastsætte regler om udstedelse af helbredsgodkendelser og krav til helbred for personer, der udfører sikkerhedsklassificerede funktioner på jernbaneområdet, herunder om udtagning af blod-, sved- og urinprøver i forbindelse med helbredsundersøgelser.)
x	x	x	x	x	§66	Stk. 1	Trafikstyrelsen godkender uddannelser til udførelse af sikkerhedsklassificerede funktioner på jernbaneområdet.

x	x	x	x	x	§66	Stk. 2	Transportministeren godkender uddannelsessteder for lokomotivførere i henhold til krav, der er fastsat i retsakter fra Den Europæiske Union.
x	x	x	x	x	§66	Stk. 3	Trafikstyrelsen kan fastsætte nærmere regler om de uddannelser, der er nævnt i stk. 1, herunder regler om certificering, uddannelsernes indhold og krav til lærere.
x	x	x	x	x	§67	Stk. 1	En sikkerhedsklassificeret person må ikke udføre eller forsøge at udføre sikkerhedsklassificerede funktioner, når den pågældende 1) har indtaget spiritus i et sådant omfang, at den pågældende er ude af stand til at udføre sikkerheds-klassificerede funktioner på fuldt betryggende måde, 2) har en alkoholkoncentration i blodet på 0,20 promille eller derover, 3) har indtaget bevidsthedspåvirkende stoffer i et sådant omfang, at den pågældende er ude af stand til at udføre sikkerhedsklassificerede funktioner på fuldt betryggende måde, 4) har blod, der under eller efter udførelsen af den sikkerhedsklassificerede funktion indeholder bevidsthedspåvirkende stoffer, som efter regler fastsat af justitsministeren er klassificeret som farlige for færdselssikkerheden, jf. færdselslovens § 54, stk. 1, og som ikke er indtaget i henhold til en lovlig recept, 5) har indtaget bevidsthedspåvirkende stoffer i henhold til en lovlig recept, hvis indtagelsen ikke er sket i overensstemmelse med recepten og den pågældende er ude af stand til at udføre sikkerhedsklassificerede funktioner på fuldt betryggende måde, eller

							6) på grund af sygdom, svækkelse, overanstrengelse eller mangel på søvn eller af lignende årsager befinder sig i en sådan tilstand, at den pågældende er ude af stand til at udføre sikkerhedsklassificerede funktioner på fuldt betryggende måde.
x	x	x	x	x	§67	Stk. 2	En arbejdsgiver eller anden foresat må ikke lade nogen udføre sikkerhedsklassificerede funktioner i forbindelse med driften af jernbanevirksomhed eller infrastrukturforvaltning, når den pågældende befinder sig i en tilstand som nævnt i stk. 1.
x	x	x	x	x	§67	Stk. 3	Har en arbejdsgiver eller en anden foresat formodning om, at en person udfører eller forsøger at udføre sikkerhedsklassificerede funktioner i en sådan tilstand som nævnt i stk. 1, skal arbejdsgiveren eller den foresatte sørge for, at den pågældende fritages for de sikkerhedsklassificerede funktioner.

		x			§67	Stk. 6	Stk. 1-5 finder tilsvarende anvendelse på personer, der udfører kørsel med letbanekøretøjer på områder omfattet af færdselslovens § 1.
x	x	x	x	x	§70	Stk. 2	Trafikstyrelsen fører tilsyn med, at indehaveren af et sikkerhedscertifikat eller en sikkerhedsgodkendelse jf. §§ 39 b og 59 overholder gældende lovgivning på jernbaneområdet vedrørende interoperabilitet, beredskab, jernbanesikring og jernbanesikkerhed, herunder farligt gods, helbredskrav, uddannelseskrav, anlæg til sikring af vejtrafikken i niveauoverkørsler, godkendelse af jernbanekøretøjer og jernbaneinfrastruktur m.v. Trafikstyrelsen kan ligeledes føre tilsyn med sikkerhedsmæssige ydelser, som udføres af andre virksomheder for indehaveren af et sikkerhedscertifikat eller en sikkerhedsgodkendelse
x	x	x	x	x	§70	Stk. 3	Trafikstyrelsen fører tilsyn med, at personer, der udfører sikkerhedsklassificerede funktioner, jf. § 65, besidder de nødvendige helbredsmæssige og faglige kvalifikationer.
x	x	x	x	x	§78	Stk. 1	Virksomheder på jernbaneområdet skal give indberetning til Trafikstyrelsen til brug for styrelsens forebyggende jernbanesikkerhedsmæssige arbejde om ulykker og forløbere for ulykker samt sikkerhedsmæssige uregelmæssigheder på jernbaneområdet.
x	x	x	x	x	§78	Stk. 2	Ansatte i virksomheder på jernbaneområdet og personer, der udfører sikkerhedsklassificerede funktioner på jernbaneområdet, skal give indberetning til den virksomhed, som de er ansat i, om ulykker og forløbere

							for ulykker samt sikkerhedsmæssige uregelmæssigheder på jernbaneområdet.
x	x	x	x	x	§79	Stk. 1	Jernbanevirksomheder og infrastrukturforvaltere skal hvert år fremsende en sikkerhedsrapport omhandlende det foregående kalenderår til Trafikstyrelsen.
x	x	x	x	x	§80	Stk. 1	Jernbanevirksomheder og infrastrukturforvaltere skal foretage nødvendig planlægning og træffe nødvendige foranstaltninger for at sikre jernbanen og jernbanedriften i beredskabssituationer og andre ekstraordinære situationer. Jernbanevirksomheder og infrastrukturforvaltere skal indbyrdes koordinere planlægning og udførelse af beredskabsopgaver, herunder også vedrørende jernbanesikringsopgaver og opgaver varetaget af virksomhedshjemmeværnet.
x	x	x	x	x	§80	Stk. 2	Jernbanevirksomheder og infrastrukturforvaltere skal endvidere foretage nødvendig planlægning og træffe nødvendige foranstaltninger for at sikre passagerers personlige sikkerhed i beredskabssituationer og andre ekstraordinære situationer.
BEK nr 711 af 20/05/2020							
					§3	Stk. 1	Jernbaneinfrastruktur, der ikke er omfattet af forordningen for risikovurdering (CSM-RA), skal opfylde kravene til risikovurdering i bilag 1-3 til denne bekendtgørelse.
x	x	x	x		§4	Stk. 1	Ansøgning om ibrugtagningstilladelse skal ske ved brug af Trafik-, Bygge- og Boligstyrelsens ansøgningsskema.

x	x	x	x		§5	Stk. 1	Ansøgningen til Trafik-, Bygge- og Boligstyrelsen om en ibrugtagningstilladelse til et strukturelt delsystem i jernbaneinfrastrukturen skal vedlægges: 1) systemdefinition, 2) sikkerhedsvurderingsrapport i overensstemmelse med CSM-RA eller bilag 1-3 i denne bekendtgørelse udarbejdet af en assessor, jf. § 11, hvis ændringen af delsystemet vurderes signifikant, jf. CSM-RA eller bilag 1-3 til denne bekendtgørelse, 3) forslagsstillers skriftlige erklæring om, at alle identificerede farer og risici ved disse farer er holdt på et acceptabelt niveau, jf. CSM-RA artikel 16 og bilag 1, afsnit 7, i denne bekendtgørelse, hvis ændringen af delsystemet vurderes signifikant, jf. CSM-RA eller bilag 1-3 til denne bekendtgørelse, 4) en EF-verifikationserklæring, jf. interoperabilitetsdirektivets artikel 15, hvis delsystemet er omfattet af en TSI, herunder attest med tilhørende teknisk dossier udarbejdet af et bemyndiget organ, jf. bekendtgørelse om krav til bemyndigede organer på jernbaneområdet, og 5) Det Europæiske Jernbaneagenturs godkendelse af udbud vedrørende fast ERTMS-udstyr, hvor Agenturets godkendelse er påkrævet, jf. jernbanelovens § 60 b.
x	x	x	x		§7	Stk. 1	Før en ændring i en eksisterende jernbaneinfrastruktur iværksættes, skal den virksomhed, der påtænker ændringen, vurdere, om ændringen er signifikant

							efter principperne i artikel 4, stk. 1 og 2, i CSM-RA eller bilag 1 i denne bekendtgørelse.
x	x	x	x		§7	Stk. 2	Vurderes det, at ændringen, jf. stk. 1, er signifikant, skal virksomheden forelægge ændringen for Trafik-, Bygge- og Boligstyrelsen som anført i § 9.
x	x	x	x		§8	Stk. 1	Ændring af et delsystem, som ikke er omfattet af vurderingen i § 7, stk. 2 eller 3, kræver ikke en ibrugtagningstilladelse fra Trafik-, Bygge- og Boligstyrelsen. Sådanne ændringer gennemføres i overensstemmelse med jernbaneinfrastrukturforvalterens sikkerhedsledelsessystem.
x	x	x	x		§9	Stk. 1	Inden ændring af et eksisterende delsystem, der vurderes at være signifikant eller som betragtes som fornyelse eller opgradering jf. § 7, stk. 2 eller 3, indsendes en projektbeskrivelse til Trafik-, Bygge- og Boligstyrelsen, inden ændringen iværksættes. Trafik-, Bygge- og Boligstyrelsen træffer afgørelse om, hvorvidt ændringen kræver en ny ibrugtagningstilladelse i henhold til § 4.
x	x	x	x		§9	Stk. 2	Projektbeskrivelsen skal indeholde følgende: 1) Dokumentation for virksomhedens vurdering om ændringens signifikans, jf. § 7. 2) En foreløbig systemdefinition af ændringen af delsystemet, herunder oplysninger om: a) virksomheden ønsker at anvende dokumentation fra en tilsvarende ændring, som tidligere har opnået en godkendelse i Danmark, et EU- eller EØS-land efter identiske krav under tilsvarende driftsbetingelser, og

							b) hvorvidt ændringen efter virksomhedens vurdering er omfattet af TSI-krav.
x	x	x	x		§10	Stk. 1	Trafik-, Bygge- og Boligstyrelsen udsteder tilladelse til test på eksisterende strækninger.
x	x	x	x		§10	Stk. 2	Såfremt en virksomhed ønsker at udføre en test på en eksisterende strækning af et eller flere del-systemer eller dele af delsystemer, som ikke er omfattet af en ibrugtagningstilladelse, skal virksomheden før testens iværksættelse vurdere, om testen medfører en signifikant ændring af jernbanesystemet efter artikel 4, stk. 1 og 2, i CSM-RA eller bilag 1 til denne bekendtgørelse.
x	x	x	x		§10	Stk. 3	Vurderes det, at testen medfører en signifikant ændring af jernbanesystemet, jf. stk. 2, skal jernbaneinfrastrukturforvalteren ansøge om tilladelse til test hos Trafik-, Bygge- og Boligstyrelsen inden iværksættelse. Ansøgning om tilladelse til test skal vedlægges: 1) en systemdefinition, 2) en sikkerhedsvurderingsrapport, jf. CSM-RA artikel 15 eller bilag 1-3 til denne bekendtgørelse, udarbejdet af en assessor, jf. § 11, og 3) forslagsstillers skriftlige erklæring i henhold til CSM-RA artikel 16 eller bilag 1, afsnit 7, i denne bekendtgørelse.

x	x	x	x		§11	Stk. 3	Assessor skal være akkrediteret i overensstemmelse med bekendtgørelse om krav til akkreditering af assessorer på jernbaneområdet, når denne vurderer følgende ændringer, herunder tests i forbindelse med: 1) Infrastrukturprojekt, som har egen anlægslov eller aktstykke. 2) Ændring, som omfatter det europæiske togkontrol og signalsystem (ERTMS). 3) Ændring, som omfatter landsdækkende etablering af delsystemer eller landsdækkende udskiftninger af delsystemer.
x	x	x	x		§11	Stk. 4	En assessor, som ikke er akkrediteret, skal godkendes af Trafik-, Bygge- og Boligstyrelsen efter bekendtgørelse om godkendelse af assessorer og sagkyndige i forbindelse med godkendelse af jernbaneinfrastruktur og køretøjer.
x	x	x	x		§12	Stk. 1	Jernbaneinfrastruktur må ikke tages i brug, før Trafik-, Bygge- og Boligstyrelsen har udstedt ibrugtagningstilladelser til de i jernbaneinfrastrukturen anvendte strukturelle delsystemer.
x	x	x	x		§12	Stk. 2	Et strukturelt delsystem i jernbaneinfrastrukturen, hvortil Trafik-, Bygge- og Boligstyrelsen har udstedt ibrugtagningstilladelse, må kun tages i brug af en jernbaneinfrastrukturforvalter.
x	x	x	x		§12	Stk. 3	Inden et strukturelt delsystem i jernbaneinfrastrukturen tages i brug, skal jernbaneinfrastruktur-forvalteren implementere de fornødne risikoforanstaltninger i henhold til reglerne om godkendelse af jernbaneinfrastrukturforvaltere.

Appendix 2 – Interview guide

The appendix contains the interview guide used for acquiring input from stakeholders working with SMS for infrastructure according to Research question 2 and Research question 3.

No	Danish	English translation
1	Hvilken lovgivning er relevant for din SMS?	Which legislation is relevant for your SMS?
2	*Metro/letbane: Er der forskel på de krav der stilles til din SMS i forhold til konventionel jernbane?*	*Metro / light rail: Is there a difference in the requirements for your SMS in relation to conventional rail?*
3	Kan du give mig en gennemgang af opbygningen af jeres SMS? - Indhold/opbygning? - Format (processer, regelsæt, etc.)? - Brugerflade (papir, web, program)? - Regler for brug (f.eks. ingen lokale kopier)?	Can you give me a review of the structure of your SMS? - Content / structure? - Format (processes, rules, etc)? - User interface (paper, web, program)? - Rules of use (e.g. no local copies)?
4	Hvordan (hvis?) adskiller i det jernbanesikkerhedsbærende SMS med andre krav til et ledelsessystem (medarbejderes sundhed, miljø, kvalitet, osv., fx efter standarderne ISO 9001, ISO 14001, ISO 45001 eller BS 8800)?	How (if?) do you distinguish the railway safety-bearing SMS with other requirements for a management system (employees' health, environment, quality, etc., e.g. according to the standards ISO 9001, ISO 14001, ISO 45001 or BS 8800)?
5	I hvilken grad er krav omkring andres aktørers godkendelser bygget ind i jeres SMS (RS, entreprenørcertifikater, o. lign.)?	To what extent are the requirements for other actors' approvals built into your SMS (RS, contractor certificates, etc.)?
6	Er der nogle områder der erfaringsmæssigt er lagt meget fokus på (f.eks. pba. personlige eller organisatoriske erfaringer)? - f.eks. human factor, vedligehold, etc.?	Are there any areas that, from experience, have been given a lot of focus (e.g. due to personal or organizational experience)? - for example. human factor, maintenance, etc.?

7	Har I erfaringsmæssigt ramt nogle udfordringer i opbygningen af jeres SMS?	From experience, have you encountered any challenges in building your SMS?
8	Har størrelsen af jeres organisation været en faktor i opbygningen af jeres SMS?	Has the size of your organization been a factor in building your SMS?
9	Hvordan håndterer I opdateringer af SMS (ændringer teknisk/organisatorisk, risikoprofil, tekniske regler mv?)	How do you handle SMS updates (changes technical / organizational, risk profile, technical rules, etc.?)
10	Ud over safety targets og indrapportering, benytter I nogle metoder til at sikre SMS opfyldelse af funktion (målsætninger)? - f.eks. KPI ang. vedl.?	In addition to safety targets and reporting, do you use any methods to ensure SMS fulfilment of function (objectives)? - for example. KPI regarding maintenance?
11	Benytter I nogle akkrediterede certificationsordninger til at sikre jernbanesikkerhedsmæssige målsætninger?	Do you use any accredited certification schemes to ensure railway safety objectives?
12	Hvis der ved udvikling eller opdatering af jeres SMS havde fandtes en common-basis approach, ville I da have set fordele i at benytte dette? - Hvorfor/hvorfor ikke?	If a common-basic approach existed when developing or updating your SMS, would you have seen advantages in using this? - Why / why not?

Appendix 3 – Transcription and condensation of interviews

The appendix contains the transcription of interviews with infrastructure managers along with the condensation.

A is short for author (interviewer), IM is short for infrastructure manager (respondent). Where the interview was conducted in Danish, an English translation is supplied.

Lokaltog

Person (IM/A)	**Danish**	**English translation**	**Condensation**
A	Jeg har arbejdet med fysiske ændring af infrastrukturen i forhold til CSM-RA i rigtig mange år, og i al den tid så har jeg jo altid hygget mig meget med at finde ud af, hvordan de forskellige infrastrukturforvaltere gøre tingene fordi det er jo meget forskelligt. I forbindelse med specialet her, så tænkte jeg, at så kunne det være interessant at se hvor meget common-basis man i virkeligheden kunne lave ud af de krav der ligger til infrastrukturforvalterne. Så det er øvelsen her, det er det jeg prøver at undersøge. I den forbindelse så vil jeg jo rigtig gerne have noget best practice, fordi jeg kan jo	I have worked with physical changes of infrastructure in relation to CSM-RA for many years, and in all that time I have always enjoyed finding out how the different infrastructure managers do things because it is very different. In relation to this thesis I thought that it could be interesting to see how much common-basis one could actually make out of the requirements for the infrastructure managers. So this is the exercise here. This is what I'm trying to investigate. In that connection, I really want some best practice, because I can sit and come up with some dream scenarios, but that does	-

	godt sidde og finde på et eller andet drømme kastel, men det betyder jo ikke rigtig det virker i virkeligheden, og deraf det her interview. Og jeg tænker, vi bare skulle hoppe ud i det?	not really mean it works in reality, and hence this interview. And I guess we should just get into it?	
IM	Ja, men lad os gøre det.	Yes, but let's do it.	-
A	Hvad er det for en lovgivning, som I ser som relevant for jeres SMS?	What is the legislation that you see as relevant to your SMS?	-
IM	Lige nu der er vi jo certificeret efter bekendtgørelse 147. Og ligesom alle andre der skal vi jo også over på 712 og CSM-SMS, så det kommer vi jo. Jeg er heldigvis bare lidt foran for engang skyld, sådan så at jeg bad om at blive re-certificeret lige inden at vi kom ind i fjerde jernbanepakke her den 16. juni det sidste eller forrige år, hvor at jeg så fik forlænget vores sikkerhedscertifikat efter 147, så jeg fik faktisk skabt mig selv lidt ekstra tid, så vi havde mulighed for at tage det roligt, fordi ellers så havde vi jo skulle haste igennem, og det bliver altid nogle dårlige løsninger.	Right now we are certified according to Executive Order 147. And like everyone else, we also have to switch to 712 and CSM-SMS, so we will. Luckily, I'm just a little ahead for once, so I asked to be re-certified just before we entered the fourth railway package here on June 16 last year or the year before that, which was when I got our safety certificate extended after 147, so I actually got to create myself a little extra time, so we had the opportunity to take it easy, because otherwise we would have had to rush through, and there will always lead to some bad solutions. So I	Recertified on 147. Happy with this as it gives more time for implementation of requirements in 172/CSM-SMS.

	Så jeg fik skabt noget tid, og det vil sige vi skal først om 2 år faktisk overgå til CSM-SMS. Medmindre selvfølgelig der er nogle større ændringer, som har indflydelse på vores sikkerhedscertifikat. Men ellers så kører vi efter 147 nu og vi skal efter det andet.	gave us some time, and that means we will not actually switch to CSM-SMS until 2 years from now. Unless of course there are some major changes that affect our security certificate. But otherwise we follow the 147 for now and we have to go after the other.	
A	Og i forhold til de aktiviteter I laver, er det passagertransport primært eller har I også noget gods?	And in relation to the activities you do, is it primarily passenger transport or do you also have some goods?	-
IM	Vi har på vores sikkerhedscertifikat og også mulighed for at kører med noget gods, men det er det jo primært eget forbrug kan man sige som infrastrukturforvalter, men vores hovedaktivitet, det er passagerkørsel. Bare lige for at vende den kort, har vi 9 baner liggende på Sjælland og Lolland, så alt det der ikke er Banedanmarks infrastruktur og alt den kørsel, hvor jernbanevirksomheden ikke er DSB, det er vores i Østdanmark, så dækker vi resten.	We have on our safety certificate and also the opportunity to transport some goods, but it is primarily our own consumption you can say as an infrastructure manager, but our main activity, is passengers . Just to turn it around, we have 9 tracks located on Zealand and Lolland, so all that is not BaneDanmark's infrastructure and all the transportation where the railway company is not DSB, it is ours in Eastern Denmark, we cover the rest.	Passenger transport
A	I ligger ret spredt?	You are quite scattered?	-

IM	Ja, det ligger over det hele. Sådan rent historisk, så er det jo de enkelte baner der så er blevet samlet, og så i (*20*)15 der blev vi så lokaltog og slog det sidste sammen, så nu er der ikke mere i Østdanmark der kan slås sammen. Og vi også er begge dele, vi er både infrastrukturforvalter og jernbanevirksomhed, så vi er jo både Banedanmark og DSB på samme tid, så der er lidt ekstra at se til sådan rent papirmæssigt.	Yes, it's all over Eastern Denmark. Historically, it is the individual railroads that have been merged, and then in (*20*)15 we became Lokaltog and merged the last, so now there is no more within Eastern Denmark that can be merged. We are both; we are both infrastructure manager and railway company, making us both Banedanmark and DSB all at once, so there is a little extra work at in such a purely administratively way.	Individual railroads merged in several steps, latest in 2015. Both infrastructure manager and railway operator.
A	Har I, i forbindelse med jeres re-certificering, så gjort jer nogle overvejelser omkring hvor connected jeres SMS er som infrastrukturejer (*infratrukturforvalter*) og operatør eller var det helt straight forward?	Have you, in relation to your re-certification, made any considerations about how connected your SMS is as an infrastructure owner *(infrastructure manager*) and operator or was it completely straightforward ?	-
IM	Det er fuldt integreret i dag, vi kører kun et. Og så er vi faktisk med at blive SCM-certificeret (*supply chain management*) nu i forhold til vores vedligehold, altså vores værksteder. Det er også vores eget materiel	It is fully integrated today, we only run one. And then we are actually becoming SCM-certified (*supply chain management*) now in relation to our maintenance, i.e. our workshops. It is also our own equipment	SMS does not differ between roles as infrastructure manager and railway operator.

	og vores egen værksteder, så vi har hele pakken. Det giver altså nogle fordele, men det kræver også noget ekstra arbejde. Så, vi har det fuldt integreret i vores sikkerhedssystem i dag, og vi havde faktisk så sent som i fredags DSB på besøg i forhold til deres projekt omkring førerløse S-tog, fordi der bliver de jo også lidt infrastrukturforvalter. Og så kom de ud og kiggede hos os om, hvordan vi ligesom havde integreret det i vores sikkerhedssystem, så det er meget højaktuelt det her med, hvordan vi gør.	and our own workshops, so we have the whole package. So it does offer some benefits, but it also requires some extra work. So, we have it fully integrated into our safety system today, and we actually had as late as last Friday DSB on a visit in relation to their project around driverless S-trains, because there they will also be a bit infrastructure manager. And then they came out and looked to us as about how we had kind of integrated it into our security system, so it's very topical this with how we do.	
A	Hvornår hiver I så tredjeparter ind? Er det så til udbud til ændringer? Eller laver I alt selv?	So when do you pull in third parties? Is it then for tender for change? Or do you do everything yourself?	
IM	Hvis det er det vi kalder tredjeparts projekter, det vil for eksempel der kommer et eller andet stort elselskab, som skal have skudt en eller anden underføring. Det er det, vi kalder tredjeparts projekter. Eller	If this is what we call third-party projects, it will, for example, be some big electricity company that must have shot some underpass. This is what we call third-party projects. Or some want to get something	Performs most maintenance themselves. Major work including safety services is bought

	nogle ønsker at få lavet noget. Ellers så har vi jo selv vores infrastruktur og dér, hvor vi så køber sikkerhedsmæssige ydelser, som det primært vil være det. Hvis vi skal have bygget en nyt bro eksempel, det gør vi ikke selv. Men alt hvad der hedder tilpasning og opbygning osv. det gør vi primært selv. Vurderer det selv, gør det ene eller det andet, og så kan det være vi køber rådgivere til og regne det ud, eller hvis det er specielle maskiner eller andet, så køber vi selvfølgelig dem ind, men det vil ikke være tredjepart, det vil jo være vores egen første leverandør.	done. Otherwise, we have our own infrastructure and where we then buy security services, as it will primarily be. If we are to have built a new bridge example, we are not doing it ourselves . But everything that is called adaptation and construction, etc., we do that primarily ourselves. Evaluate it yourself, do one or the other, and then it may be we buy consultants for and figure it out, or if it is special machines or something, then of course we buy them, but it will not be a third party. It will, after all, be our own first supplier.	and performed by entrepreneurs.
A	Så køber I ydelserne ind via en rammeaftale eller lignende?	So you buy the services via a framework agreement or similar?	-
IM	Ja.	Yes.	-
A	Har I adskilt jeres SMS i forhold til jernbanesikkerhed fra alt den andet sikkerhed, man jo selvfølgelig også skal leve op til. Her tænker jeg på sådan noget	Have you separated your SMS in relation to railway safety from all the other safety, which of course you also have to live up to? I am thinking of such a thing as work	-

	som arbejdsmiljø og deslige. Altså er der en adskillelse i systemet?	environment and the like. So is there a separation in the system?	
IM	Som det er lige nu, ja, det er adskilt. Vi tog en ny platform i brug her 1. februar (*2022*). Der er det så at på sigt, at vi kommer til for eksempel arbejdsmiljø eller andet, at det er den samme platform. Men alt hvad der hedder processor, procedurer og alt det her, det kommer aldrig nogensinde til at blive skrevet ind i det samme, ikke så længe jeg sidder her, i hvert fald, fordi det det vil altid gå galt. Så ja, alt hvad der hedder sikkerhed vil være vil være adskilt. Men det kan godt være det kommer til at ligge på samme portal, men adskilt derinde også.	As it is right now, yes, it is separate. We launched a new platform on February 1st (*2022*). It is so in the long run that we come to, for example, work environment or something else, that it is the same platform. But everything called processor, procedures and all this; it's never going to be written into the same thing, not as long as I'm here. As it always end up going wrong. So yes, everything called safety will be separated. But it may well be that it will be on the same portal but separate in there as well.	Rail way safety is separated from other types of safety. Same platform, but not same procedures and processes. Personal experience that failures occur if they are written together.
A	Allerede der så svarer det faktisk lidt på mit næste spørgsmål, så i hvert fald delvist fordi at. Fordi at jeg er faktisk også lidt nysgerrig på hvordan I bygger jeres processer og procedurer, jeres format, op. Fordi nu har jeg jo erfaring fra Banedanmark, der er jo meget noget med	That there actually already answers a bit of my next question, at least partly. Because I'm actually also a little curious about how you how you build your processes and procedures, your format. As I have experience from Banedanmark, there is a lot to do with core procedures and then	-

	core procedures og så er der alt de andet rundt omkring. Er det samme setup, struktur?	there is everything else around. Is it the same setup , structure?	
IM	Vi har gjort det på en lidt anden måde, jeg ved i forhold til DSB, der kører de jo... Nå, det er også lige meget. Vi har valgt at gøre det sådan så at vi har selvfølgelig kigget på, hvad er det for nogle ting, som vi skal leve op til men når det så er sagt, så gør vi det meget ud for brugeren. Og det betyder, at alle de processer, der nu er for, for eksempel infrastruktur, ting og sager, der har vi i vores sikkerhedssystem ligesom lavet et felt, der nu hedder infrastruktur, og så har vi samlet alle de procedurer, der ligger deri, og det vil sige alt de skal bruge det finder de der. Og det være sig alt lige fra instruktioner til blanketter, til det ene og det andet. Selve proceduren, altså skabelonen for hvordan vi bygger vores procedurer op, der har vi qua vi skulle have det nye system og qua, at det ikke skulle	We have done it in a slightly different way, of what I know about DSB, and how they run it ... Never mind, that doesn't matter. We have chosen to do it that way, but also how do we live up to the requirements but having said that we do it a lot for the user. And that means that all the processes that are now for, for example, infrastructure, things and cases that we have in our security system just like made a field that is now called infrastructure, and then we have gathered all the procedures that are in it, and that is, everything they need they find is there. It can be everything from instructions to forms, to the one and the other. The procedure itself, i.e. the template for how we build our procedures, which we have since we made the system and that it should not be a significant change if we	Basis for SMS is requirement mapping, followed up with user interface (ease of use, logic for the user). Processes are mapped according to overall areas, and procedures, instructions, check forms, etc. is mapped within the procedures of the relevant area (infrastructure, traffic, materials, etc). All documents are situated in one place, and given as links in an area/procedure/etc.

	være en signifikant ændring, at vi pludselig lavede om på strukturen, så er den meget tekstbaseret, så er det meget prosa. Men den er bygget op i aktiviteter som kommer step wise. Så du starter altid med hvad omhandler denne her procedure, hvem er den gældende for, hvad er det, vi lever op til med den her procedure, og hvad formålet generelt. Hvad er inputtet, hvad er det der sætter den i gang, og så har du så alle de der aktiviteter der så kører dernede. Først så skal ham her der har ansvaret for denne her aktivitet og så næste aktivitet, osv. På sigt der kommer vi også til at skulle illustrere det her, så vi får den grafiske... Det kan så være svim lanes eller tilsvarende. Det har vi nogle enkelte, men kommer til og blive bedre til det, men vi går ikke væk fra teksten. Jeg vil gerne have begge dele. Og det bare igen brugerperspektiv. Nogle kan lide at læse, andre kan lide at se det grafisk,	suddenly changed the structure, then it is very text-based, so it's a lot of prose. But it is made up of activities that come step wise. So you always start with what this procedure is about, who it is for, what we live up to with this procedure, and what the purpose is in general. What is the input, what is it that sets it in motion, and then you have all those activities that then run down there. First, the person who is responsible for this activity and then the next activity, etc. In the long run, we will also have to illustrate this, so we get the graphic ... It can then be faint lanes or something similar. We have a few, but we will get better at it, but we will not move away from text. I want both. Again, just from user perspective. Some like to read, others like to see it graphically, so it becomes a both -	The setup is chosen partly to avoid migrating to 172 at the update (*new system according to other answer*). Text-based approach combined with visual procedures and swim lanes. Basis for a process is the purpose, requirements, relevant users, input/activation. Then the procedure shows activities distributed on roles. Basis for a procedure and/or instruction is text based. In future the text

	så det bliver en både -og løsning. (*HER DELES SKÆRMEN OG SMS VISES*). Vi kalder det ETLOK, for et lokaltog. Det er ligesom vores sikkerhedssystem. Hvis jeg bare lige skal sætte to ord på det, så vi ikke bruger al vores tid på det, men bare lige så du kan se det; her på forsiden der kan du se det her med, at vi har en afdeling, der hedder projekter, infrastruktur, materiel, trafik, vi har noget sikkerhed og uddannelse og sådan hele tiden, og det vi har prøvet at opbygge det efter det er 3-kliks princippet det her med, at uanset hvor du er, så kan du i løbet af 3 klik med musen, så får du altså den procedure eller blanket op du skal bruge. Det er super fedt. Det er svært at lave, men vi er faktisk kommet ret godt i mål med det. Så hvis vi holder os i eksemplet omkring infrastruktur, så er vi en infrastrukturmedarbejder: Klik på infrastruktur så kommer han op på denne her her igen. Min tilgang til	and solution. (*SHARES THE SCREEN HERE AND SMS SHOWN*). We call it ETLOK, for Lokaltog. It's like our safety management system. If I just have to put two words on it so we do not spend all our time on it, but just so you can see it; here on the front page there you can see this with the fact that we have a department called projects, infrastructure, equipment, traffic, we have some safety and education and such all the time, and what we have tried to build it after it is 3-click the principle here with that no matter where you are, you can in 3 clicks with the mouse, so you get the procedure or form you need. It's super cool. It's hard to do, but we've actually gotten pretty good at it. So if we stick to the example of infrastructure, then we have an infrastructure employee. Click on infrastructure and he will come up with this here again. My approach to user involvement it is quite large, so here the	will be supported with more visualization. 3-click principle. Setup made with involvement from actors in the areas, to ensure the interface is best possible for the actors. Document- and process owners are shown, as well as the legal basis. Links are given in the processes/procedures/ instructions to create traceability and ease of use.

	brugerinvolvering den er ret stor, så her der har infrastruktur afdelingen af sig selv bestemt hvad er det for nogle processer og procedurer, hvad er det for kasser I har mest brug for. Og det er dem, vi så har lagt øverst nu. Du kan se for eksempel banenormer, leverandøroversigt osv. Ellers så vil vi finde samtlige procedurer under procedurer, samtlige instruktioner under instruktion osv. Så hvis vi bare kigger i procedurer, så er det her kun procedurer som er relevant for infrastruktur. Så har vi pillet alt det andet fra. Selvfølgelig ligger alle de her dokumenter kun et sted, så det er jo ligesom links over til, sådan så vi kun skal rette det et sted, ellers er det jo en fejlkilde. Her, bare for at tage fejlretning på infrastruktur, hvis vi skal se formålet det er at sikre, at alt er i forsvarlig stand osv., hvem er det der er med, hvem har funktioner i proceduren og så det her input, hvad er det der starter den. Det er eller	infrastructure department has by itself determined what it is for some processes and procedures, which boxes you need most. And these are the ones we have put at the top now. You can see, for example, track standards, supplier overviews, etc. Otherwise we will find all procedures under procedures, all instructions under instruction, etc. So if we just look at procedures, then here are only procedures that are relevant to infrastructure. Then we peeled everything else off. Of course, all these documents are only in one place, so it's like links to, so we only have to edit them in one place, otherwise it's a source of error. Here, just to take error correction on infrastructure, if we are to see the purpose it is to ensure that everything is in sound condition, etc., who is it with, who has functions in the procedure and then this input, what is it who starts it. It is some kind of error or process that is being	

	anden fejl eller proces der bliver indmeldt eller et problem der bliver indmeldt, og så kan vi se hernede, Der er det jo så denne her funktion, der har ansvaret for denne her aktivitet. Step 2, når den vurdering den er sket, så skal man iværksætte restriktioner, udbedring. Når det er sket så skal det oprettes i, osv. Så på den måde bliver det ligesom gennemgået dernedad sådan i processen. Herude i siden der kan vi se der er alle henvisninger. Det er her, der for eksempel bliver skrevet instruktioner, hvad er det for systemer vi bruger til det osv. Har vi nogen definitioner således slå det op i ordbogen og hvor skal det så registreres, og hvor lang tid skal det eventuelt gemmes. Og så har vi alle henvisningerne hernede som links også, som der også indgår i proceduren. Det er sådan vores procedure ser ud i dag. Og så har vi jo som dokument informationer her. Hvem er det, der er ansvarlig, og Det er jo så ham, der altid har	reported or a problem that is being reported, and then we can see below. It is this function that is responsible for this activity. Step 2, once the assessment has taken place, then one must implement restrictions, remediation. When it has happened then it has to be created etc. So in that way it is like going through down there like that in the process. Out here in the page there we can see all the references. This is where, for example, instructions are written, what are the systems we use it for etc. Do we have any definitions, then we look it up in the dictionary and where should it then be registered, and how long should it possibly be stored for. And then we have all the references below as links as well, which are also included in the procedure. This is how our procedure looks today. And then we have information here as a document. Who is responsible it, and who is	

	(*ansvaret for*) at det lever op til det, den skal. Og hvem er det der godkender det, det er på chefniveau. Hvornår er det reviderede ting og sager? Og så kan vi så se, hvilken bekendtgørelse og hvilke punkter det er, at denne her faktisk dækker.	permanently(*responsible for*) that it lives up to what it is supposed to. And who is it that approves it, it's at the managerial level. When are the audited things and cases? And then we can then see what executive order and what points it is that this one actually covers.	
A	Hvordan håndterer I løbende opdateringer, hvis vi ser bort fra I selvfølgelig har en re-certificering, som selvfølgelig skal indhentes hver 5. år? Hvis I nu sidder med procedurer, så kan I se der er noget galt her, det virker ikke som de skal?	How do you handle regular updates, if we disregard the fact that you of course have a re-certification, which of course must be obtained every 5 years? If you are now sitting with procedures, then you can see there is something wrong here, it does not work as they should?	-
IM	Men, der vil for eksempel her der står der AT som er ansvarlig for den her procedure, hvis han får for det første, så kan vi jo få kommentarer i systemet. Hvis der sidder nogen og siger at det passer faktisk ikke så vil AT jo sidde med denne her, så får han en mail der siger du har fået en kommentar på din procedure P42: fejlretning på	But, for example, here it says AT who is responsible for this procedure, if he gets first, then we can get comments in the system. If someone is sitting and says that it actually does not fit, AT will sit with this one, then he will receive an email saying that you have received a comment on your procedure P42: error correction on	Changes, outside re-certifications, are made through deviation-logging. Anyone can log a deviation, the person responsible will be

	infrastruktur, omhandlende bla bla bla. Så kan de jo snakke om hvad det er der skal gøres, og så kan han gå ind og rette det her og som det er lige nu, igen bare fordi det er nyt, så vil han jo checke ud at det hele det virker. Vi har sådan et ændringsgrundlag - er det små rettelser, komma fejl osv. så godkender vi den bare - men ellers så har vi faktisk et dokument der beskriver hvad er det du ønsker at ændre, hvorfor gør du det, har du håndteret det hele ved, hvad du skal, lever det stadig op til kravene, osv. Og hvis det er ja,. så kan den så blive sendt til CHS, som er godkender. Det er jo chefen, som bare ikke skal forholde sig til om processen er bygget efter vores procedurer og så videre, men ren og skær, står der her at det nu har en meromkostning eller hvad han kigger på. Og så trykker han godkend, og så bliver den udgivet med det samme. Det har vi selvfølgelig også en proces for hvordan vi gør.	infrastructure, concerning this and that.. Among other things. Then they can talk about what needs to be done, and then he can go in and fix it and as it is right now, again just because it's new, then he will check out that it all works. We have such a basis for change - is it small corrections, comma errors, etc. then we just approve it - but otherwise we actually have a document that describes what it is you want to change, why do you do it, have you handled it all know what you need, it still lives up to the requirements, etc. And if it is yes, then it can then be sent to CHS, which is the approver. After all, it is the boss who just does not have to relate to whether the process is built according to our procedures and so on. It says here that it now has an additional cost or what he is looking at. And then he approves, and then it gets released right away. Of course, we also have a process for how we do that.	notified and must act on it. Basis for amendment allows for small changes to be approved without higher approval, otherwise documentation control describe how changes shall be made (i.e. compliance). The owner of the subject where a deviation is logged, is responsible to follow change procedures/instruction. Higher approval does not look at the content itself.

A	Så går jeg også ud fra I har nogle regler for brug? Fordi betyder det så at hvis jeg skal et eller andet så hvis jeg skal have en skabelon så skal jeg faktisk ind og hente den fra ETLOK? Jeg kan ikke have en lokal kopi liggende, for den kunne være ændret siden sidst?	So I also assume you have some rules of use? Because does that mean that if I need something then if I need a template then I actually have to go in and download it from ETLOK? I cannot have a local copy lying around because it could have been changed since last?	-
IM	Ja, det vil du skulle kunne. Dermed ikke sagt at der ikke findes skabeloner som ligger derude, og når jeg siger det så er det fordi at ETLOK ligesom er vores sikkerhedsledelsessystem i forhold til vores procedurer. Men sikkerhedsledelsessystemet er jo bredere end bare det system. Det er jo også vores vedligeholdelsessystem for køretøjer, det er også vores planlægningsprogram i forhold til opsætning af vores lokomotivførere til tjeneste og ting og sager, og derimellem findes der nogle ting. Når det så er sagt, så har vi for eksempel skabeloner til at ligge herinde til et eller	Yes, you want to be able to. This is not to say that there are no templates out there, and when I say that it is because ETLOK is just like our safety management system in relation to our procedures. But the safety management system is broader than just that system. After all, it is also our maintenance system for vehicles, it is also our planning program in relation to setting up our locomotive drivers for service and things and cases, and in between there are some things. That being said, for example, we have templates to put in here for something, and we have started making them after we got the system digital as	Before change to the new system, most things was logged on paper. Everything was in the system, but local copies cannot be avoided using a paper-based system. Transfer to digital platform means that digital logging has started to be made, e.g. deviations are now logged digitally.

	andet, og dem er vi så begyndt at lave, efter at vi har fået systemet digitale også. Et eksempel på det kunne være afvigelser hvor at nu har vi så bare en formular, hvor man går ind og siger hvad, hvor er det henne osv. Igen, keep it simple. Vi kan altid gøre det bredere og det betyder bare at den er når oprettet så får chefen for området som man vælger her en e-mail der siger du har haft en afvigelse der omhandler det her. Nu skal du sætte din afvigelsesansvarlig på, og så vil jeg for eksempel kunne sætte én af mine mellemledere til og sige det er dig der har den. Og igen, vi klikkede kun et sted, og så kan vi gå ind og kan kigge på alle afvigelser, der ligger. Der er nogen der så er blevet overskredet, kan du se. Jeg kan gå ind og se mine poster, har jeg nogen der ligger her, nemt for mig Jeg har denne her omkring noget organisationsændring som jeg skal klare for direktionen. Men det ligger samme sted, men det vil være et	well. An example of this could be deviations where that now we just have a form where you go in and say what, where is it, etc. Again, keep it simple. We can always make it wider, and it just means that it is when created then the boss of the area as you choose here gets an email saying you have had a deviation dealing with this. Now you have to put your deviation manager on, and then I will, for example, be able to put one of my middle managers and say it is you who has it. And again, we only clicked one place and then we can go in and look at all the deviations that are there. There is someone who has then been exceeded, you can see. I can go in and see my posts, I have some there, which are easy for me. I have this thing here about some organizational change that I have to handle for the management. But it is in the same place, but it will be a digital, so nothing has to be printed, but it has to be	Digital deviations are made through a simple digital form, the owner is notified, and a responsible actor can be designated. A list of deviations is kept, including deadlines and can be sorted according to owner/responsible. In the future, working on tablets and laptops is prioritized. Paper requires "double work".

	digitalt, så så der ikke skal printes noget, men det skal gøres via tablets eller i systemet her ETLOK. Sådan bliver det nok mere fremadrettet, hvor at indtil da så har vi det på papir, som så skal lægges ind og tastes ind.	done via tablets or in the system here ETLOK. This is probably more likely in the future, because for now, we have it on paper, which needs to be logged.	
A	I forhold til den opbygning af jeres SMS er der noget, der har været mere eller mindre udfordrende, sådan i brugen af det?	In relation to the structure of your SMS, is there anything that has been more or less challenging, such as in the use of it?	-
IM	Og når du siger i brugen af det og du snakker opbygning samtidig, er det så systemet, eller er det for brugernes at kunne finde de?	And when you say in the use of it and you talk building at the same time, is it then the system, or is it for the users to be able to find them?	-
A	Begge dele i princippet, ud fra en betragtning af, at det er jo lige så vigtigt at det virker i virkeligheden, som at opbygningen er på plads.	Both in principle, based on the consideration that it is just as important that it works in reality as that the structure is in place.	-
IM	Hvis vi starter med den tekniske opbygning, så valgte jeg det her system, fordi du kan styre det hele selv. Nogen systemer, nogle kvalitetsledelsessystemer og sikkerhedssystemer, det er jo	If we start with the technical structure, then I chose this system because you can control it all yourself. Some systems, some quality management systems and security systems, it's simply, here you have a field where you	Control of system build is important, in order to be able to tailor it.

	simpelthen, her der har du et felt der skal du skrive sådan her og du kan ikke gå ud over det, og det har bestemt det hele. Det her system fra IPV, det er grafisk, så alt det du kigger på her det er mere eller mindre bare et billede og så lægger man genvejene ovenpå som et lag. Det gør, at vi kan få det til at se ud, ligesom vi vil. Det betyder også, at når det er så smidigt og vi kan gøre det hele selv, for eksempel også det her med afvigelserne, nu tager jeg bare formularen, hvis jeg i morgen eller om 2 minutter vil have et ekstra felt ind her der skal vælges noget, eller det ikke skal hedde titel, men den skal hedde chef eller et eller andet, så kan vi selv gå ind og gøre det, hvor at i andre systemer så skal vi have fat i en eller anden tech support der sidder og kan programmere. Det koster alle byens penge og det tager 4 år. Jeg kan ændre det her på 3 minutter. Super fordel. Ulempen er så, at det kræver, at man ved, hvad man laver. Jeg	have to write like this and you cannot go beyond it, and it has determined it all. This system from IPV, it's graphic, so everything you look at here is more or less just a picture and then you put the shortcuts on top as a layer. It allows us to make it look the way we want it to. It also means that when it is so smooth and we can do it all ourselves, for example also this with the deviations, now I just take the form, if tomorrow or in 2 minutes I want an extra field in here to choose something, or it should not be called a title, but it should be called a boss or something, then we can go in and do it ourselves, where in other systems we have to get hold of some tech support that sits and can program. It costs a lot, and it takes 4 years. I can change this in 3 minutes. Super advantage. The downside is that it requires knowledge of what you are doing I've been so lucky, so I've hired someone who's been working on	Uses graphical build, where links are layered on images. Easy tailoring, where the user can do build-changes themselves, instead of using a tech support and/or heavy programming, is preferred. Easy tailoring does require competences that knows the system i.e. a programme/programming competence in-house. This includes the general build itself (the basic system).

	har været så heldig, så jeg har ansat en, som har arbejdet med det her system i mange år, så hun er rigtig dygtig, og hun har en masse gode ideer. Hvis jeg ikke havde haft det, så havde jeg nok haft problemer. Nu er vi begyndt at lære det så så nu er jeg ikke så sårbar mere, men hvis hun var smuttet midt i det hele, så var jeg ikke nået så langt på så kort tid som jeg er. Det er ulempen. Så er det er svært at gøre det komplicerede simpelt. Sådan er det jo altid. Jeg skød lidt efter stjernerne og prøvede det her 3-kliks princip og det er vi faktisk kommet rigtig godt i mål før, og det betyder så for at lave en glidende overgang til brugeroplevelsen af det her, mega gode tilbagemeldinger. Nu kan de faktisk finde det. Tidligere der kom vi fra et system hvor at vi havde word dokumenter, excel ark osv. og det et helvede at komme op og får dem til at finde det. Og når det er svært, så bruger de det ikke, og når de ikke bruger det, så virker det	this system for a lot of years, so she's really good and she's got a lot of good ideas. If I had not had that, then I probably would have had problems. We're now starting to learn to use it so I'm not so vulnerable anymore, but if she had skipped out in the middle of it all, then I would not gotten this far, in the short time that I have had. That's the downside. Then it's hard to make the complicated simple. That's always the case. I shot after the stars and tried this 3-click principle. We have actually done really well before that, and that means to get a smooth transition to the user experience of this, mega good feedback. Now they can actually find it. Earlier we came from a system where we had word documents, excel sheets etc. and it was hell to get up and get them to find it. And when it's hard, they do not use it, and when they do not use it, then it does not work, then it is pure of sheer paper exercise. We have come along	Difficult to make to a complicated system simple, but the return in user satisfaction is worth it (i.e. spend the time to make a system user friendly). 3-click principle has given good user feedback. The digital system, tailored to the organization, means that the users can find things in the system. A system where things cannot be found, is not used, and therefore does not work.

	ikke, så er det ren af skær papir øvelse. Vi er kommet rigtig godt med og de er rigtig glade for det, og jeg skal også være ærlig at sige at mange af de områder og medarbejdere, som går helt ude i den spidse ende, de har jo ikke været vant til at komme ind og få adgang til det her, fordi det har ligget på en computer og computeren kunne de ikke tage med ud på skinnerne og det vil sige, så har det jo primært været de administrative funktioner, altså planlæggere og ledere og den slags ting, der sidder der. Men den enkelte medarbejder, hvis vi bliver på infrastruktur, som går rundt og skruer de her bolte i derude, han har aldrig nogensinde været inde og kigge rigtigt, det tror jeg simpelthen ikke på. Men nu begynder det ligesom at være der, hvor det er interessant at kigge på. Nu begynder det at være der, hvor han kan få det på telefon og tablet, så han rent faktisk kommer til at kunne stå derude og gøre	really well, and they are really happy about it, and I must also be honest to say that many of the areas and employees who go all the way to the end, they have not been used to gaining access to this because it has been on a computer and the computer they could not take out on the rails and that is, it has primarily been the administrative functions, i.e. planners and managers and the kind of things that is there . But the individual employee, if we stay on infrastructure that goes around screwing these bolts in out there, he has never ever been in and looked right, I simply do not believe that. But now it's just starting to be where it's interesting to look at. Now it's starting to be where he can get it on phone and tablet so he's actually going to be able to stand out there and do some different things. And when he's in doubt, he can just look it up. To entice a little, as I said, it's new we have only been in the air with it for	On top of this, a system that makes sense, will be used, and therefore work. I.e. make sure the user is included in the interface and content (on top of the legal requirements). The difficult group of workers to reach is the ones in the field, as they don't have/use a laptop regularly. Giving them a tablet/laptop/phone and making the system digital ensures that it is easier for them to use when performing their job. Combining the SMS with an intranet, with functions that they will use (i.e.

	nogle forskellige ting. Og når han er i tvivl, så kan han lige slå det op. For at lokke lidt, som sagt er det nyt vi har jo kun været i luften med det i 2 måneder nu, så er vi i gang med at lave for eksempel indrapportering af ferieansøgninger, kørselsgodtgørelser, ting og sager, så vi begynder lidt at bruge det lidt som et intranet - det har vi nemlig heller ikke – så nu lokker vi dem ligesom ind i portalen på denne er front. Det tror jeg faktisk også kommer til at give bonus, fordi så ser de lige noget, det var meget interessant osv. Som du kan se på vores forside, så har jeg sådan noget som beredskabsplanen for eksempel liggende med et stor rød knap. Det er bare fordi, sker der nu noget, så skal den ikke være svær at finde. Den skal ikke ligge nede i bunden helt nede i hjørnet den skal man bare kunne trykke på, og så får du den frem. Når så du har trykket, og det kan jo så også være ude i skinnerne, så har vi	2 months now, so we are in the process of reporting holiday applications, travel allowances, things and cases, so we start to use a little it's a bit like an intranet - we do not have that either - so now we lure them just like into the portal on this front. I actually think it will also give a bonus, because then they just see something, it was very interesting, etc. As you can see on our front page, I have something like the contingency plan, for example, with a big red button. It's just because if something happens now, it should not be difficult to find. It should not be at the bottom at the very bottom in the corner, you just have to be able to press it, and then you get it out. When you have pressed, and it can also be out in the rails, then we have all those instructions. We have fire and rescue. We have everything around there with phone lists. So you do not have to stand and miss this, it must be completely in front, and	vacation application, etc.) can “lure” people into the system. Create focus through visualization on important topics (example is emergency planning). Make IT (relatively) simple.

	alle de der vejledninger, vi har brand og redning. Vi har alt deromkring med telefonlister. Altså du skal ikke stå og mangle det her, det skal ligge helt fremme, og så kan vi jo igen bare det der 3-kliks princip Jeg mangler et telefonnummer, et klik, 2 klik, så har vi faktisk telefonlisten på det hele, og vi har det også på den eksterne, så hvis det er brandvæsen, hvis det er Politi, hvis det er et eller andet helt specifikt, så får vi den her. Og så er det selvfølgelig stadigvæk i den der brugervenlighed, ligesom alle andre systemer, har du behov for nogen, så kan du lægge dem som de der kviklinks. Hvis de ikke kan magte at klikke 3 gange så kan de så kan de lave genvej til de ellers plejer at bruge. Jeg skrev mail adresser til trafikstyrelsen, for eksempel, fordi det bruger jeg ret meget. Så jeg vil sige vores brugere er glade for det. Vi har selvfølgelig, fordi vi har fået trukket det op i lyset nu, en ret stor pulje af folk, der	then we can again just that 3-click principle I need a phone number, a click, 2 clicks, then we actually have the phone list on it all, and we also have it on the external, so if it's fire department, if it's Police, if it's something very specific, then we get it here. And then of course it's still in that usability, like all other systems, if you need any, then you can put them as those quick links. If they cannot manage to click 3 times then they can then they can make shortcut to what they normally use . I wrote email addresses to the traffic department, for example, because I use it quite a lot. So I would say our users are happy with it. We have, of course, because we've got it pulled up in the light now, a pretty big pool of people who suddenly discover what it was they should have done. So that is to say, we go in and adapt our procedures now quite a lot, because they find out that this is not what we do, we do this. My approach is	

	pludselig opdager hvad det var, de burde have haft gjort. Altså det vil, sige vi går ind og tilretter vores procedurer nu ret meget, fordi de finder ud af at det er da ikke det det vi gør, vi gør jo sådan her. Min tilgang er at jeg sådan set ligeglad med - jeg sætter x'et på kortet det her der skal vi nå det og så kommer vi her nede fra, men i midten der står der alt muligt, men om de går højre eller venstre om, det må de bestemme. Det er deres hverdag og hvordan de gør det, det er jeg sådan set ligeglad med bare de når krydset, altså så er vi derhenne. Det begynder de nu og kan se, fordi de kan se det hænger sammen, når de kan finde det. Så begynder det også at give mening for dem. Og når det giver mening, så bliver det brugt. Og kan vi finde det og det giver mening, så er vi nået langt. Selv jeg kan finde ud af det. Jeg er også rimelig effen til det, men det er ikke sværere end som så, men det er bare også svært at skulle lave det	that I kind of do not care - I put the x on the map this here we have to reach it and then we come down from here, but in the middle there is everything, but whether they go right or left, they must decide. It's their everyday life and how they do it, I kind of don't care if they just reach the crossroads, so then we're there. They start it now and can see because they can see it is connected when they can find it. Then it also starts to make sense to them. And when it makes sense, it's used. And if we can find it and it makes sense, then we have come a long way. Even I can figure it out. I'm also fairly good at it, but it's not harder than that, but it's just too hard to have to do it all when you do not have a template. But we had some guidelines and frameworks we had set, among other things by this 3-click principle and so this with the structure must be on the user's terms	

	hele når du ikke har en skabelon. Men vi havde jo nogle retningslinjer og rammer vi havde sat, blandt andet ved det her 3-kliks princip og så det her med opbygningen skal være på brugerens vilkår		
A	Jeg kan i høj grad genkende det fra noget af det, som Banedanmark også diskuterede nogle år tilbage.	I can certainly recognize it from some of what Banedanmark also discussed some years ago.	-
IM	BDK, bare for at vende den, de har jo gjort det lidt anderledes. De har jo valgt at tage deres kerne ting og deres støtte procedurer og deres det og det andet. Jeg kommer hvad DSB tidligere og sag også med det sikkerhedsledelsessystem dengang, og var uenig (*i det, fordi*) det betød også bare, at du som chef sidder og har ansvar i 4 forskellige områder, som er fordelt ud over 5 forskellige kasser. Det er bare svært at finde ud af. Og medarbejderne kan heller ikke helt finde ud af, nu når jeg skal kigge i denne her procedure, hvor finder jeg den. Det var den del af Vores kerneprodukt, så	BDK, just to turn it around, they've done it a little differently. After all, they have chosen to take their core stuff and their support procedures and their this and that. I come what DSB earlier and case also with the safety management system at the time, and disagreed (*with it, because*) it also just meant that you as a boss sit and have responsibility in 4 different areas, which are distributed over 5 different boxes. It's just hard to figure out. And the employees cannot quite figure it out, either now that I have to look in this procedure, where I find it. It was that part of our core product, so	Experience that management-wise, it is difficult to navigate a system where responsibility/procedures are split into many different areas instead of shown in a coherent manner.

	er det nok her, men lige om lidt, der skal jeg bruge hinanden som… Her der er jeg i infrastruktur, så her klikker jeg og så får jeg, hvad jeg skal bruge. I stedet for at sprede det, så har vi samlet det – her er hvad du skal bruge som infrastrukturmedarbejder.	it's probably here, but in a little while I'll need each other as… Here I'm in infrastructure, so here I click and then I get what I need. Instead of spreading it, we have put it together - here's what you need as an infrastructure worker.	
A	Og det så ud fra en betragtning af, at man som bruger er en lille smule ligeglad med, om det er kerne eller støtte, jeg skal bare vide hvordan jeg skal lave mit arbejde?	And it looked from a consideration that as a user you are a little bit indifferent to whether it is core or support, I just need to know how to do my job?	-
IM	Fuldstændig. Jeg skal skrue denne her i, hvad skal jeg bruge, hvor skal jeg gemme det? Så kan vi andre snakke om det (*systemet*) på gangen i stedet for.	Exactly. I have to screw this in here, what do I need, where do I store it? Then we others can talk about it (*the system*) in the hallway instead.	The practical end-user does not care what the theoretical basis for your system is (i.e. is it a core or a supporting process), as long as the system supports the purpose of their job.
A	Hvis man så ser på indholdet af et SMS, fordi styrelsen og ERA har jo masser af krav - er der noget du erfaringsmæssigt kan	If you then look at the content of an SMS, because the agency and ERA have lots of requirements - is there something you can	-

	se kræver mere end andre punkter, om det skulle være træning eller beredskab eller lignende?	see from experience requires more than other points, whether it should be training or emergency preparedness or the like?	
IM	Dér hvor vi har kæmpet mest i vores virksomhed, dér hvor vi har haft sværest ved ligesom at komme ind til noget, så har det jo blandt andet været CSM-RA. Det er klart jo en af de ting som har trukket helt vildt store veksler på alt og alle vil jeg sige. Frustrationen omkring det, det har været en langvarig proces igennem det hele, og jeg oplevede det samme i DSB og de andre virksomheder som vi også snakker rundt med. Og noget af det der har været årsag til det har jo til dels været den der kulturrejse, der har været fra, hvad vi ellers bare kunne og så til de krav, der bliver stillet nu. Og det der så har forvirret endnu mere det er også noget i forhold til myndighedernes håndtering af de ansøgninger, vi har. De har jo også til at starte med at være lidt på bar bund, og så har man jo løbende fundet ud	Where we have struggled the most in our company, where we have had the hardest time, like getting into something, it has been CSM-RA, among other things. It is clearly one of the things that has pulled wildly large bills on everything and everyone I would say. The frustration around it, it has been a lengthy process through it all, and I experienced the same thing in DSB and the other companies that we also talk around with. And some of what has been the reason for that has partly been the cultural journey that has been from what we otherwise just could and then to the demands that are being made now. And what have been more confusing, is in relation to the authorities' handling of the applications we have. They have also started from square one, and then you have	Method implementation is difficult; partly due to a shift in safety culture, from experience-based to requirement-based; party due to lack of cohesive approach in the overall business. The CSM-RA method is subject for opinions, and it is difficult to navigate opinions. Approvals that are managed on a large(r) national and/or European scale, outside the internal organization, are difficult

	af noget. Så har der faktisk været stor forskel på de sagsbehandlere og de rådgivere og assessorer, osv. Alle har deres egen holdning til, hvordan tingene skal gøres, og eftersom at vi snakker om, at det er en vurdering, så har det været svært at finde ud af hvordan at how to. Hvornår er nok nok, hvilken metode skal vi bruge, osv. og så videre. Og så kom fjerde jernbanepakke. Én ting er at nu synes jeg, at vi begynder at have godt styr på specielt infrastrukturændringer på CSM-RA delen, men nu kan vi så trække den over i køretøjer. Og i køretøjer, det har jo ofte været vedligeholdt det, det har ofte været Styrelsen, man har kunnet ringe (*til*) og få nogle nye ibrugtagningstilladelser. Efter det blev til køretøjsomsætningstilladelser og ansøgninger igennem OSS, og inden OSS blev ordentlig med de fejl og mangler og børnesygdomme, som det havde, så har vi	continuously figure something out. Then there has actually been a big difference between the caseworkers and the advisers and assessors, etc. Everyone has their own opinion on how things should be done, and since we are talking about it being an assessment, it has been difficult to find out how to. When is enough, enough, what method should we use, etc. and so on. And then came the fourth railway package. One thing is that now I think we are starting to have proper control of especially infrastructure changes on the CSM-RA part, but now we can then pull it over in vehicles. And in vehicles, it has often been maintained, it has often been the Agency, you have been able to call (*to*) and get some new commissioning permits. After that it became vehicle sales permits and applications through the OSS, and before the OSS became proper with the errors and deficiencies and early faults that it had,	to assess the impact of. And does not always work as intended ("prototype errors"). Implementing a known method in a new field can be equally difficult (CSM-RA on RS). All requirement implementation impacts an operational organization in a negative manner, when the implementation and consequences/work is not regulated, and no one can guide.

	lige pludselig nogle nye systemer, vi skal forholde os til. Vi har ikke personale som er er gode nok til det dér. Lige nu har jeg blandt andet H, som er dygtig til CSM og har både siddet i styrelsen, Banedanmark, og alle mulige andre steder. Nu sidder hun og prøver at skulle trække det her igennem med materiellet. Hun aner intet om materiel. Vores vedligeholdelsesfolk på værkstedet ved, groft sagt, intet om hele godkendelsesregimet, fordi det er jo nyt. Så det vil sige, vi har jo ikke rigtig nogen der ”er der” og for et par år siden, da vi startede, der vidste styrelsen det heller ikke, så vi gik hånd i hånd med styrelsen for at kigge det igennem og finde ud af hvad der var godt og skidt. Det hermed at vi nu pludselig skal have typegodkendelser og versioner, og altså hvornår er hvad, og det er jo tungt læsestof og der er ingen af os der er jurister. Så det bliver bare rigtig, rigtig tungt og der sker bare hele tiden fejl eller tilbageløb, og	then all of a sudden we have some new systems we have to deal with. We do not have staff who are good enough for that. Right now I have, among other things, H, who is good at CSM and has been on the board, Banedanmark, and all sorts of other places. Now she's sitting and trying to pull this through with the material. She has no idea about material. Our maintenance people in the workshop know, roughly speaking, nothing about the entire approval regime, because it is new. So that means we do not really have anyone who "is there" and a couple of years ago, when we started, the agency did not know it either, so we went hand in hand with the agency to look it through and find out of what was good and bad. This means that we now suddenly have to have type approvals and versions, and so when is what, and that is heavy reading material and none of us are lawyers. So it	

	det tager lang tid og vi har fået længere sagsbehandlingstider, og alle prøver at dække sig ind under skakurs-princippet hvor vi skal have minimum have x antal måneders sagsbehandlingstid. Fakta er at vi er en driftsorganisation. Og det vil sige, når vi skal lave noget om, så kan vi sgu ikke vente 6 til 9 måneder for at have fået en ny godkendelse. Vi skal ind i flere systemer. De solgte jo faktisk OSS på, at når vi skulle have vores køretøjsomsætningstilladelser, så trak den selv data over fra ERA TV. Og det gør de heller ikke. Det er en udfordring det er det virkelig.	just gets really, really heavy and there are just mistakes or setbacks all the time, and it takes a long time and we have had longer case processing times, and everyone tries to cover themselves under the shake course principle where we must have a minimum of x number of months. case processing time. The fact is that we are an operating organization. And that means when we have to change something, we cannot wait 6 to 9 months to get a new approval. We need to get into more systems. After all, they actually sold US on the fact that when we had to have our vehicle set-up permits, it itself withdrew data from ERA TV. And neither do they. It's a challenge it really is.	
A	Så kan man lidt groft sagt sige, at de her basisfunktioner i en SMS som træning eller registre og eller monitorering osv., det er egentlig ikke det der udfordrer?	So you can roughly say that these basic functions in an SMS such as training or registers and or monitoring, etc., is not really that challenging?	-
IM	Nej, det synes jeg ikke (*Ja, det kan man godt sige*). Det er mere de her godkendelses	No, I do not think so (*yes, you can say that*). It is more these approval regimes that we	The basis-requirements in SMS requirements

	regimer som vi ikke kun har in-house. For 5 år siden der vil jeg vove at påstå, at der var vi ikke modne nok til at kunne håndtere det selv. Det var helt fair at der var nogen, der ligesom skulle ind og kontrollere det arbejde, vi havde lavet. I dag er vi et helt andet sted. I dag har vi også fået købt de her medarbejdere, som kan hjælpe os med det, fordi man var ikke gearet. Jeg kommer hertil for 4 år siden, og stak hovedet direkte ind i... Ja der røg vi nok lige et par år tilbage i forhold til hvad jeg havde regnet med, men det er jo ikke noget som Lokaltog tidligere havde arbejdet med, fordi de har haft den samme infrastruktur længe. De har haft de samme køretøjer, de havde haft trafikken der bare kører, ikke så mange der blandede, så det kørte faktisk bare ganske fornuftigt. Når der var noget tog man i snak med trafikstyrelsen og så købte man de ydelser til de tekniske løsninger, der nu måtte være, hvis det bliver kompliceret.	do not only have in-house. 5 years ago there I would venture to claim that there we were not mature enough to be able to handle it ourselves. It was quite fair that there was someone who just had to come in and check out the work we had done. Today we are in a completely different place. Today we have also bought in these employees who can help us with it because they were not geared. I came here 4 years ago, and stuck my head directly into ... Yes, we probably went a couple of years back compared to what I had expected, but it's not something that Lokaltog had previously worked with, because they have had the same infrastructure for a long time. They've had the same vehicles, they'd had the traffic just driving, not so many mixings, so it actually just functioned quite sensibly. When there was something, you talked to the Danish Transport Authority and then you bought the services for the	(training, registration, monitoring, etc.) for certification are not in themselves difficult. Approvals (not in-house) for intermittent changes, and the associated paper work/hours/money requires more focus than the internal organization itself.

	Den går bare ikke mere. Nu er der jo forordninger, EU har skrevet dem og Styrelsen kan ikke hjælpe. Der er meget mere papir der bliver sat meget større op, osv. Så i dag har vi fået gearet vores organisation helt anderledes. Vi står jo lige overfor at regelforvaltning bliver lagt ud til os selv. Og det vil sige styrelsen fremadrettet ikke skal godkende hverken tekniske eller trafikale regler. Det har jeg valgt at skyde lidt, fordi det det mener jeg ikke vi er modne nok til endnu, men vi har de medarbejdere, vi skal og vi skal bare finde ud af, hvordan vi gør. Det er igen fordi at vi snakker assessor, og nu bliver jeg lidt grov og skærer over én kam og generaliserer lidt. Men jeg vil sige i starten i forhold til CSM-RA så var det en pengemaskine og den samme pengemaskine ser vi hos rådgiverne i dag, at lige så snart at man lige stikker lillefingeren ud - og det er man lidt nervøs	technical solutions that may now be, if it gets complicated. It just does not work anymore. Now there are regulations, the EU has written them and the Agency cannot help. There is a lot more paper that gets put up a lot bigger, etc. So today we have geared our organization completely differently. We are just about to face rule management being outsourced to ourselves. And that means that in future the agency will not have to approve either technical or traffic rules. I have chosen to push a little, because I do not think we are ready enough for that yet, but we have the employees we need, and we just need to find out how we do it. It's again because we're talking assessor, and now I'm getting a little rough and making assumptions and generalizing a little. But I would say in the beginning in relation to CSM-RA it was a money machine and the same money machine we see in the advisers today, that	

	for, som virksomhed, når man skal ud at have fat i dem. Når så loven kommer og siger, at det skal i, hvordan styrer vi så dem. Hvornår er nok nok? Og når man har rådgivere på, så er det jo for at man skal have hjælp til den opgave man skal løse. Og hvis de så bare løber af og laver projektet alt for bredt, hvis det er et projekt, man skal have hjælp til. Så er du jo prisskilt altså, så hver gang at vi har et signifikant projekt i dag så skal vi minimum lægge en million oveni og et halvt års sagsbehandling. Og det har vi ikke råd til. Det kan godt være vi er Danmarks næststørste jernbanevirksomhed, Danmarks næststørste infrastrukturforvalter…	as soon as you just stick your little finger out - and you are a little nervous about that, as a company, when going out and grabbing them. When the law comes and says that it should in how we then govern them. When is enough, enough? And when you have advisors on, it is because you need help with the task you have to solve. And if they just run off and make the project too wide if it's a project you need help with. So you are price tag, so every time we have a significant project today, we must add a minimum of one million and a half years of case processing. And we cannot afford that. It may well be that we are Denmark's second largest railway company, Denmark's second largest infrastructure manager…	
A	Sammenlignet med Banedanmark, så det siger ikke så meget.	Compared to Banedanmark, so that does not say much.	-
IM	Præcis. Og det er bare for at sige at Midtjyske og Nordjyske osv. de er jo endnu	Exactly. And that's just to say that Midtjyske and Nordjyske etc. they are even	Railway has become expensive because it is

	mindre end os. Altså Midtjyske er blevet rigtig store nu. Det er jo lige doblet op så nu de er jo næsten ved at være på 50 medarbejdere. Og de er ikke gearet til det her, fordi halvdelen af alle vores medarbejdere er lokomotivførere og dem der arbejder på banen og håndværkere på værkstedet, og så har vi måske 50 i administrationen. Vi skal dække det hele på alle fronter, så det er et problem. Det er blevet dyrt at køre jernbane, fordi vi skal have hjælp i mange gange. Det tror jeg faktisk er det største problem ellers så holder vi godt fast i sikkerhedsafdelingen, fordi at man ude i de enkelte afdelinger, de kan godt følge deres procedurer, men det bagvedliggende og alt det besværlige papirarbejde og paragrafferne det kan de simpelthen ikke holde rede i, og det er helt forståeligt.	smaller than us. So Midtjyske has become really big now. It has just doubled up so now they are almost 50 employees. And they are not geared for this because half of all our employees are locomotive drivers and those who work in the field and craftsmen in the workshop, and then we have maybe 50 in the administration. We need to cover it all on all fronts, so that's a problem. It has become expensive to run the railway because we need help many times over. I actually think this is the biggest problem otherwise we stick to the security department, because out in the individual departments, they can well follow their procedures, but the underlying and all the cumbersome paperwork and paragraphs they simply cannot keep track in, and that is quite understandable.	not just running operations, but also managing intermittent changes and added requirements – for which help is needed. To incorporate and make the regulations “live” in the operation, a translating layer is needed to communicate the law into actual processes/instructions/ etc. to the end-user.
A	Er vi lidt tilbage i den her den her brugergrænseflade, at de skal vide hvad de	Are we doubling back to this user interface that they need to know what to do, and then	-

	skal gøre, og så kan det godt være, vi skal træne dem i det nye. Men de skal bare ikke vide hvorfor, sådan i detaljerne?	it may well be that we need to train them in the new? But they just do not need to know why, like in the details?	
IM	De behøver ikke vide hvorfor, men at det er sådan det er, og så er det det. Og det samme i forhold til SCM og alt muligt andet, det er jo komplekst, men de skal bare vide at de skal følge proceduren. Og så vi tilbage til, at hvis vi beskriver, som vi gør og gør, som vi skriver, osv., så går det jo fint.	They do not need to know why, but that it is the way it is, and so it is. And the same in relation to SCM and everything else, it's complex, but they just need to know that they have to follow the procedure. And then we go back to the fact that if we describe as we do and do as we write, etc., then it goes well.	The end-user does not need to know every detail of why they do what they do, but needs to know why they must follow a process/procedure/etc. As system only works if the describe what we do and do what we describe.
A	Jeg havde en overvejelse omkring hvorvidt et sikkerhedssystem skulle geares efter størrelsen på organisationen. Men hører jeg rigtigt, når det måske mere handler om kompetencerne i organisationen?	I had a consideration about whether a security system should be geared according to the size of the organization. But am I hearing you right when I say it might be more about the competencies of the organization?	-
IM	For det er der er jo ingen grund til at lave et stort forkromet system, hvis du ikke er så stor, at du ellers kan overskue det. Der er jo	Because there is no reason to make a large system if you are not big enough, so you can manage it. After all, there are no	Except for veteran trains, the requirements are the

	ikke nogen krav til how-to-do. Men når det så er sagt, så er størrelsen af virksomheden.. vi er lige over 500 mand, og det betyder også at vi har en størrelse, hvor at kompleksiteten er større, end hvis du var den lille entreprenør der er derude. Det er de samme krav, vi skal leve op til, uanset om vi er det ene eller det andet. Kompetencestyringen er svær, fordi vi har rigtig mange funktionsbeskrivelser, og den vil være nemmere, hvis du er en mindre virksomhed, fordi så kan du reelt lave det som en stillingsbeskrivelse, hvor du skriver funktionerne ind og så de 10 mand du har rendende der skriver du så bare hvad det er de skal. Hvor vi har mange folk, der skal kunne lave mange forskellige (*ting*), så derfor har vi modulopbygget den, kan man sige. Vores funktionsbeskrivelser er jo delt op, og dem har vi ret mange af. Hvis vi tager en lokomotivfører. Hver funktionsbeskrivelse; hvem er det, hvor	requirements for how -to-do. But having said that, the size of the company is .. we are just over 500 employees, and that also means that we have a size where the complexity is greater than if you were the small contractor out there. These are the same demands we must live up to, whether we are one or the other. Competence management is difficult because we have a lot of job descriptions, and it will be easier if you are a small company, because then you can actually do it as a job description, where you enter the functions and then the 10 men you have running who write you just saw what it is they need. Where we have many people who need to be able to do many different (*things*), so therefore we have built it modular, you could say. Our job descriptions are divided up, and we have quite a few of them. If we take a locomotive driver. Each function description; who is it, where does he	same for all railway actors. The size of the SMS shall fit the needs of the organization. The size of the SMS can vary; the smaller the company, the simpler the SMS. But even for a large company, the SMS shall be kept simple – as far as possible: Competence management is (more) difficult in a large organization with many roles and activities, compared to a small organization with a few persons, roles and

	hører han til, er der noget omkring helbredsbekendtgørelser, andet som opgaver ansvar og beføjelser står der ligesom der skal. Og så har vi så vores modulopbygning her. Der er nogle godkendte grunduddannelser; han skal være lokomotivføreruddannet. Kernekompetencerne; han skal kende noget til vores sikkerhedssystem og så de der opgave specifikke kompetencer, der skal han litra uddannes, strækningsuddannes, osv.. På den måde har vi, ligesom kunnet på de enkelte af de her funktionsbeskrivelser. Selve styringen af det, der har vi valgt at sige alt, hvad der hedder efteruddannelse, altså lokomotivførerne får en løbende efteruddannelse, stationsbestyrer får løbene genuddannelse osv. Så behøver vi måske ikke at være knap så obs på dem her, for det bliver styret ovre på vores hvad vagt program. Der bliver de jo ikke sat op uden	belong, is there something about health notices, other things like tasks responsibilities and powers are there as it should be. And then we have our module structure here. There are some approved undergraduate programs; he must be a trained driver. The core competencies; he must know something about our safety system and then those task specific competencies, he must be litra trained, stretch trained, etc .. In this way we have, as well as been able to on the individual of these job descriptions. The actual management of what we have chosen to say everything that is called continuing education, i.e. the locomotive drivers get a continuous continuing education, station manager gets the races retraining, etc. Then we may not have to be less observant of them here, because it is managed over on our what guard program. There they are not set up without and so on, so it runs. But for	activities (including continuing education). A digital system can make competence management easier, as it restricts the potential of human error to give an assignment (that requires a certain competence) to someone who does not have a competence. This is done by making sure that functions and roles are cross-matched.

	og så videre, så det kører. Men for eksempel for sikkerhed så klikker jeg på sikkerhedsafdelingen, så får jeg markeret her. Jeg har fået et kryds i afdelingschef. Jeg har afvigelsesansvarlige, jeg kan godkende afvigelser osv. Sådan kan jeg faktisk se på alle de medarbejdere, jeg har liggende. Og når hvor jeg skal tildeles en ny jamen, så i hvert fald minimum hvert tredje år, så skal jeg have lavet en uddannelsesplan, en kompetencevurdering - kan jeg stadigvæk alt det her? Hvis jeg ikke kan, så skal der laves noget efteruddannelse. Og ja, det tager noget tid til gengæld så er det bare blevet super meget federe at få det ind i et system her. Fordi ellers så var det krydser i et excel ark, og det betyder også at den enkelte leder kan se for eksempel her A. skulle være afvigelsesansvarlig. Jeg har lavet en uddannelsesplan, men den er ikke færdig endnu så. Så hun mangler lige at få nogle	example, for security, I click on the security department, I get marked here. I've got a cross in department head. I have deviation managers, I can approve deviations, etc. This is how I can actually look at all the employees I have lying around. And when I have to be assigned a new well, then at least every three years, I must have made an education plan, a competency assessment - can I still do all this? If I cannot, then some training must be done. And yes, it takes some time but in return, so it's just gotten super much better to get it into a system. Because otherwise it was a cross in an excel sheet, and it also means that the individual manager can see, for example, here A. should be responsible for deviations. I've made an education plan, but it's not done yet. So she just needs to get some activities before it can kind of throw s up. Then A. will be marked as red and then she must not be used for it. This is	

	aktiviteter, før den ligesom kan smides op. Så vil A. stå som rød og så så må hun ikke bruges til det. Det er sådan vi har bygget vores kompetencestyring. Vi har så også ovre i, nu snakkede vi om vores system til lokomotivførerne om at de ikke kan sættes op til det litra og strækninger, som de ikke er uddannet i. Tilsvarende har vi det på værkstedet, de kan ikke udføre de vedligeholde eller eftersyn af toget, hvis de ikke har fået uddannelse i dem og det. Det bliver styret på nogle arbejdsordre, så du kan simpelthen give manden en arbejdsordre, hvis han ikke er uddannet til at kunne lave det der 50.000 meters eftersyn eller lignende. Og det samme på banen. Du kan ikke skifte et eller andet, eller smøre sporskifte, osv. hvis du ikke har fået træning i det.	how we have built our competency management. We also have over in, now we talked about our system to the locomotive drivers that they cannot be set up to the litra and lines in which they are not trained. Similarly, we have it in the workshop, they cannot perform the maintenance or inspection of the train if they have not been trained in them and that. It is controlled on some work order, so you can simply give the man a work order if he is not trained to be able to do that 50,000-meter overhaul or the like. And the same on the court. You cannot change something, or lubricate switches, etc. if you have not been trained in it.	
A	Det underlettes vel at elektronisk system som kan gå ud og sige, men opgaven kan	It is facilitated that electronic system which can go out and say, but the task cannot send	-

	ikke sende den til Jens? Det kan godt være du vil men du kan ikke?	it to Jens? You may want to, but you cannot?	
IM	Ja, præcis. Nu er det på tide at du skal lave det her eftersyn og så har du de her medarbejdere du kan tildele den. Faktisk lidt ligesom du tager eksemplet igen med de der afvigelser, hvis jeg vælger et område der hedder drift så skal jeg vælge nogen der skal håndtere den, og så får jeg kun navnene i en rulleliste over dem, som har kvalifikationen. Så dem der må.	Yes exactly. Now it's time for you to do this overhaul and then you have these employees you can assign it. In fact, a bit like you take the example again with those deviations, if I choose an area called operation then I have to choose someone to handle it, and then I only get the names in a drop -down list of those who have the qualification. So those who are allowed.	-
A	I forhold til en driftsorganisation så skal der være nogle ting på plads, men det er egentlig ikke det, der udfordrer i forhold til størrelsen af SMS, udover vi selvfølgelig skal keep it simple?	In relation to an operating organization, there must be some things in place, but that is not really what challenges in relation to the size of the SMS, besides of course we have to keep it simple?	-
	Ja og det er det der er svært, også når du er lille. Fordi hvis du er så lille, så du for eksempel med kompetencestyring, kan skrive det hele ind så du har papirdelen klaret så er min vurdering, at som lille der ved du godt, hvis den lille	Yes and that is what is difficult, even when you are little. Because if you are so small, so that you, for example with competence management, can write it all in so you have the paper part done, then my assessment is that as a child you know well, if the little	In a small company, the competence management could be managed on paper (excel sheet) in another way than in a large company; it is

	håndværksmester har 3 svende, hvem er det der er gode til at lave vogne og så er det selvfølgelig ham der gør det. Du kommer jo ikke til et uheld at sætte vores kontordame til at skifte hjul på lastvognen, så det giver sig selv. Men papirarbejdet bag hvordan du dokumenterer at de kan det her, det er det svære. Der kan det være – og her er vi tilbage til lidt myndighedernes kompetence - nu har de jo heldigvis også mandet op, men vi oplever at der har været så stor udskiftning derinde, og alle folk kommer fra skolebænken og har den teoretiske tilgang, og så mangler vi lidt den der med ”det kan godt være du siger det, men i den virkelige verden”, altså den hører man ofte ikke, og i den virkelige verden, der står man tilbage og siger, jamen, vi skal lave alt det papirarbejde. Hvordan fanden gør vi det? Så vi har brug for flere, der kan det. Som eksempel, så da jeg startede for 4 år siden, der havde jeg en mand. Lige nu	craftsman has 3 journeymen, who is it? good at making carts and then of course it is he who does it. You will not accidentally put our office lady to change wheels on the truck, obviously. But the paperwork behind how to document that they know this, that's the hard part. There it can be - and here we are back to a bit of the authorities ' competence - now they have fortunately also manned up, but we experience that there has been such a large replacement in there, and all people come from the school desk and have the theoretical approach, and so we miss the one with "it may be you say it, but in the real world", so you often do not hear it, and in the real world you stand back and say, well, we have to do all that paperwork . How the hell do we do that? So we need more people who can do it. As an example, so when I started 4 years ago, I had an employee. Right now we are 16 in the department and when you hear we are	unlikely that the clerk instead of the mechanic is asked to change a tire. A purely theoretical approach, and purely theoretical competences, are not functional in an operational organization. There must be a match between practical experience and theoretical experience (potentially through several persons). The addition of requirements, mean that conventional railway expertise, must be supported with different experiences within fields

	der sidder vi 16 i afdelingen og når du hører vi er nogle og 40 i administrationen, så sidder jeg jo næsten på 25% af administrationen. Og det er bare for at kunne administrere de krav her og prøve at være dygtige til det. Det er inklusive regelskrivere og uddannelsescenter og alt mulig andet. Det er jo fuldstændig skævt altså i forhold til hvor meget det rent faktisk kræver, så det er ret voldsomt. Men det er ikke så meget systemet, det kan vi læse os til, det er mere alt det der, hvor vi skal lave noget undervejs, hvor at vi hvor man skal diskutere og skrive, altså det er blevet et akademisk arbejde i dag kontra hvad det var for 20 år siden. Det er jernbanen bare ikke gearet til, så jeg er begyndt at købe medarbejdere ind, som ikke har arbejdet på jernbanen simpelthen for at kunne leve op til de krav der er til jernbanen. I min afdeling der har jeg på kontoret i forhold til den administrative del i uddannelsescentret	some 40 in the administration, I have almost 25% of the entire administration. And that's just to be able to manage the requirements here and try to be proficient at it. It includes rule writers and training centre and everything else. It is completely skewed in relation to how much it actually requires, so it is quite violent. But it's not so much the system, we can read about it, it's more all that, where we have to do something along the way, where we discuss and write, so it has become an academic work today versus what that was 20 years ago. The railway is just not geared for that, so I have started to buy in employees who have not worked on the railway simply to be able to live up to the requirements for the railway. In my department there I have in the office in relation to the administrative part of the training centre where I of course have "subject-subject" specialists, but otherwise	that backs the railway functions (e.g. teaching experience, legal, safety method, IT, etc.). This also means that other business areas must be used as inspiration (e.g. aviation). In order to implement legislation in due time, there is a need to look outside Danish interpretation of European legislation. It is necessary to spot requirements before they are made requirements, otherwise it is a bigger task to implements them than necessary.

	der har jeg selvfølgelig ”fag-fag” fagspecialister, men ellers så har jeg folk siddende fra Novo Nordisk, NKT, lufthavnen eller luftfarten. Luftfarten en er jo 4-5 år foran jernbanen så så jeg kigger rigtig meget ned i hvad ERA kommer med. Vi er faktisk ret førende i forhold til sikkerhedskulturarbejdet og så videre. Så jeg kigger mere ERA nu end jeg kigger trafikstyrelsen, hvis jeg skal være helt ærlig, for at spå om, hvad der kommer i fremtiden. Simpelthen for at kunne nå det. Så har jeg taget inspiration fra luftfarten, fordi det er det, det bliver det næste og så så er det den vej, vi kører. Det er igen det her med tidsperspektivet, og vi ikke får den guidance. Nu lyder det lidt voldsomt, men trafikstyrelsen skal også finde ud af hvad det er for krav, der kommer nede fra ERA og kan vi (*Lokaltog*) så spare dér og lave det rigtige så er vi jo allerede på bolden fra starten af og skal ikke vente 2-3 år til de har	I have people sitting from Novo Nordisk, NKT, the airport or aviation. The aviation one is 4-5 years ahead of the railway, so I look very much into what ERA comes with. We are actually quite a leader in terms of safety culture work and so on. So I look more ERA now than I look at the traffic department, to be completely honest, to predict what will come in the future. Simply to be able to achieve it. Then I took inspiration from aviation because that's what it's going to be next and then that's the way we go. It has to do with the time perspective, and we do not get that guidance. Now it sounds a bit harsh, but the Danish Transport Authority must also find out what the requirements are that come down from ERA and can we (*Local trains*) then save there and do the right thing then we are already on the ball from the start and should not wait 2-3 years until they have found out what they (*authorities*) thought	

	fundet ud af hvad de (*myndigheder*) troede de vidste. Og så har vi så bolden. Der blander jeg mig nu. I stedet for at det kun er Banedanmark og DSB, der har været inviteret med til bordet, så bliver vi faktisk også inviteret nu her, og det kan jeg godt lide. Men det burde jo ikke være sådan, men set er det ja. (*Krav*) opdaget for sent, og så har vi travlt. Og sådan bliver det ved et stykke tid endnu.	they knew. And then we have the ball. There I mingle now. Instead of only Banedanmark and DSB being invited to the table, we are actually also invited here now, and I like that. But it should not be like that, but seen it is yes. (*Claim*) discovered too late and then we are busy. And so it will be for a while yet.	
A	Det eneste jeg har på falderebet - det bliver aldrig nogensinde færdigt produkt indenfor den her specialetid, det kan vi alle sammen godt blive enige om - men jeg er faktisk lidt nysgerrig på om, hvis der fandtes en common approach for SMS om det overhovedet taget ville give mening med din med din erfaring og det du har arbejdet med, at tage udgangspunkt i.. man kunne kalde den certificeringsordning, man kunne kalde det et blueprint - det er ikke så vigtigt – men jeg ville aldrig nogensinde forestille	I have just one final thing, - it will never be a finished product within this special time, we can all agree on that - but I'm actually a little curious if there was a common approach for SMS if it would at all make sense of yours with your experience and what you have been working on, to take as a starting point .. you could call the certification scheme; you could call it a blueprint - it is not that important - but I would never ever imagine	-

	mig det blev et færdigt produkt. Alle skulle jo tilrette det?	it was a finished product. Everyone should adapt it, right?	
IM	Jeg vil ikke trække det så langt at jeg ville være ked af hvis der kom et færdigt produkt man skulle leve op til. Det er lidt hen ad det her med hvad er du for en virksomhed og hvordan er det I arbejder. Vi er lidt tilbage til, hvis jeg skal trække det ind i det jeg startede med at sige omkring, hvorfor jeg valgte IPV. Det var jo netop den mulighed for at kunne sætte eget præg. Hvis jeg skal trække den derhen og sige for de små virksomheder… E godt eksempel, det er faktisk vores veterantog, vores veteranbane. De skal jo ikke leve helt op til det samme. Der er jo lidt en særstatus for dem, og der ligger nogle krav til dem som er lidt specielle. De kører jo lidt på frivillig basis, og hvis vi skal tage den lille entreprenør, som skal lave det her sikkerhedsledelsessystem, så er det jo super fedt at der ligger en færdig pakke som de jo	I do want to say I would be sad if there was a finished product you had to live up to. It's a bit about what you are for a company and how you work. We're a little back to if I have to double back to what I started by saying about why I chose IPV. It was just that opportunity to be able to make your own mark. If I have to drag it there and say for the small businesses… A good example, it's actually our veteran train, our veteran track. They do not have to live up to the same thing. There is a bit of a special status for them, and there are some requirements for those who are a bit special. They run a bit on a voluntary basis, and if we have to take the little contractor who has to make this safety management system, then it's super cool that there is a finished package that they really just have to change a logo on and then they have to	A finished product for SMS should not be set in stone but be able to be tailored to the organization. A product consisting of different approaches depending on activities/size where a company could pick the one that suited best could be used, but tailoring would still be necessary (as no company is quite alike another).

	reelt bare skal skifte et logo på og så skal de bare lige se hvad der står og fylder de sidste ting i, og vupti så er de så er de klar og så kører de. Det ville nok kunne lade sig gøre, det ved jeg kunne lade sig gøre fordi det er jo det, de har gjort. Men bliver du bare lidt større så ville den løsning, som vi nu kan lave her i lokaltog. Selvfølgelig ville det kunne lade sig gøre hos DSB, hvis vi bare tager dem. Til gengæld så er DSB's organisationsstruktur og ledelseshierarki strikket sammen på en anden måde, så det jeg nu har kunnet gøre med lige at sætte mig sammen med trafik og sige, hvad kunne I godt tænke jer at have på jeres side, det ville aldrig kunne lade sig gøre i DSB fordi at den trafikdel vil bestå af at mange flere 100 mennesker fordelt på landet. Så det ville man ikke kunne gøre, og det vil sige den måde, som de så har valgt at gøre det på, hvis jeg skulle køre den så ville det ikke nødvendigvis give mening for mig, og	just see what's standing and filling the last things in, and voila: then they are t ready and then they up and running. It would probably be possible; I know it could be done because that is what they have done. But if you just get a little bigger, the solution that we can now do here in local trains would. Of course, it could be done at DSB if we just take them. On the other hand, DSB's organizational structure and management hierarchy are knitted together in a different way, so what I have now been able to do is just sit down with traffic and say, what would you like to have on your side, it would never let do in DSB because that traffic section will consist of many more 100 people distributed in the country. So you would not be able to do that, and that is the way they have chosen to do it, if I had to drive it, it would not necessarily make sense to me, and it would not necessarily make sense to the veteran track	

	det ville nødvendigvis heller ikke give mening for veteranbanen, fordi det det ville være for stort. Men man kunne måske lave den der mellemting. Hvor man siger, mindre, mellem og større virksomheder af en eller anden grad, eller man kunne lave 3 færdige løsninger hvor man så kunne vælge den man mente gav bedst mening. Sådan så du havde de her 3 forskellige approaches til best practice for denne her type. Vi kan jo se entreprenørerne; Banedanmark har jo altid kørt med at skulle forhåndsgodkende deres entreprenører, og det betød også, at for nogle år siden der satte de jo krav til, at de så skulle certificeres selv, fordi ellers så kører entreprenøren på vores sikkerhedscertifikat, og det ville man ikke have. Og dermed så bad man alle entreprenørerne om de skulle være certificeret efter 147. Aarsleff var de første der gjorde det, og så endte det det var kun 3-4 andre der måske også blev certificeret.	either, because it would be too big. But maybe you could do that in between. Where you say, smaller, medium and large companies of one degree or another, or you could make 3 ready-made solutions where you could then choose the one you thought made the best sense. So you had these 3 different approaches to best practice for this type. We can see the contractors; Banedanmark has always had to pre-approve their contractors, and this also meant that a few years ago they set requirements for them to be certified themselves, because otherwise the contractor runs on our safety certificate, and you would not have that. And thus all the contractors were asked if they should be certified after 147. Aarsleff were the first to do so, and then it ended up that there were only 3-4 others who might also be certified. They have thrown millions after that, and there were none of the little ones	

	De har kastet millioner efter det, og der var ingen af de små som jo oftest består af de der 10 mand eller så videre, der overhovedet kan komme i nærheden af det. Og dermed lavede vi den der nye standard der hedder DS:21001 som var et mini ledelsessystem for at de ligesom kunne komme på det. For det andet ville sgu være unfair. Og der ville man godt kunne lave den der fælles ting. Problemet er bare veteran banerne. Det er jo frivilligt. Det er for sjovt. Der er ikke noget kommercielt i det, de ligger ikke på hinandens baner, så derfor kunne de godt samarbejde. Men entreprenørerne, de har jo nogle kommercielle interesser, og vi deler ikke de dér forretningshemmeligheder, så derfor kunne de jo ikke gøre det på samme måde, og derfor bliver de nødt til at lave det hver for sig. Så man kunne jo sagtens lave en skabelon best practice for sikkerhedsledelse for entreprenører, for	who most often consist of those 10 men or so who can get near it at all. And thus we made that new standard called DS: 21001 that were a mini management system so that they could just come up with it. Secondly, it would be unfair. And there you would be able to do that common thing. The problem is just the veteran courses. It is voluntary. It's too much fun. There is nothing commercial in it, they are not on each other's tracks, so therefore they could well cooperate. But the contractors, they have some commercial interests, and we do not share those trade secrets there, so therefore they could not do it in the same way, and therefore they have to do it separately. So you could easily make a template best practice for safety management for contractors, for veteran trains, for small, for medium and for larger railway companies. So one would well be able to do that. I would just be sorry to lose	

	veterantog, for små, for mellem og for større jernbanevirksomheder. Så man ville godt kunne gøre det. Jeg ville bare være ked af at miste den mulighed for at tilpasse systemet til egen virksomhed.	the opportunity to adapt the system to my own business.	
A	Så måske mere interessere i noget best practice vejledning, mere end en best practice løsning?	So maybe more interested in some best practice guidance, more than a best practice solution?	-
IM	Det tror jeg. Hvis man starter som ny vil det være super fedt at få rammerne, fordi der har du ikke ideen om det, men når så er du blevet mere moden og du har gennemskuet det og du ved hvordan at tingene kommer til at hænge sammen, så er det dér man gerne vil noget mere. Så det vil være en super start men når så du kommer videre og er blevet mere moden, så skal det kunne tilpasses.	I think. If you start as a new person, it will be super cool to get the framework, because there you do not have the idea of it, but when then you have become more mature and you have seen through it and you know how things are going to stick together, then that where you want something more. So it will be a great start but when you move on and have become more mature, then it must be adaptable.	As a completely new actor a finalized frame would make more sense, than for an actor that is relatively mature. A mature actor needs to be able to tailor.
A	Er der noget jeg mangler at berøre i forhold til den snak, vi har haft, eller noget som fylder rigtig meget i din hverdag, som har med SMS'et at gøre?	Is there something I need to touch on in relation to the talk we have had, or something that takes up a lot of space in	-

		your everyday life, which has to do with the SMS?	
IM	Hvis jeg skal sætte en finger på det jeg synes er rigtig svært, så er det afvigelser. Fordi vi er jo lidt hen over CSM-Monitoring for eksempel. Det er også svært. Risikoprofilen er også svær, fordi hvad er det der menes. Teorien i det, er ikke svært at forstå, det er den faktisk ikke. Vi skal overvåge vores aktiviteter, og vi skal lære af det. Men at få det til at virke i virkeligheden, det er faktisk ret svært fordi hvordan bygger du risikoprofilen op? Jeg er ved at lave vores om nu, branchen har generelt lånt af hinanden igennem 100 år Vi er jo alle sammen en familie, i dag arbejder jeg i Lokaltog, så i morgen er det Banedanmark, i overmorgen styrelsen og så tilbage til DSB. Sådan er det bare. Dermed, så er vi jo allesammen præget lidt af den samme tankegang, når det kommer til stykket. Derfor er det godt at få noget	If I have to put a finger on what I think is really difficult, then it's deviations. Because we are a bit over CSM-Monitoring for example. It is also difficult. The risk profile is also difficult because what is meant. The theory of it, it is not hard to understand, it actually is not. We need to monitor our activities and we need to learn from them. But to make it work in reality, it's actually quite difficult because how do you build up the risk profile? I am redoing ours just now, the industry has generally borrowed from each other for 100 years. We are all a family, today I work in Lokaltog, so tomorrow it is Banedanmark, the day after tomorrow the agency and then back to DSB. That's just how it is. Thus, we are all characterized by a bit of the same mindset when it comes to it. Therefore, it is good to get some new	The difficult part of SMS is deviations, risk profile (and the connection between theory and practice). Risk profile and deviations are linked because monitoring/deviations links into learning and adjusting the risk profile. Risk profile is in itself difficult because it is often borrowed from another actor, and then adjusted to fit the specific company.

	frisk blod ind med nogle nye tilgange til det, men lige nu der tror jeg, at 90% af de jernbanevirksomheder og infrastrukturforvalter, vi kører en risikoprofil, som har lignet Banedanmarks til at starte med og så kører vi forskellige versioner. Lige nu der prøver jeg at starte helt forfra og nu har jeg så fået T. ind fra lufthavnen, fra luftfart. Og det er en helt ny måde at tænke det ind på, hvor at vi så har defineret noget risk på de enkelte aktiviteter. Men det skal jo hænge sammen i forhold til afvigelserne, i forhold til handlingsplanerne, i forhold til hændelser osv. Så det synes jeg faktisk er svært. Igen, når vi kommer ind til det her med at skulle vurdere. Kravet kan vi godt læse. Vi kan godt forstå det. Vi kan godt forstå baggrunden med, hvordan gør vi i virkeligheden. Og hvordan får vi det så helt ud. Så til sidst, hvordan kommer styrelsen	blood in with some new approaches to it, but right now I think that 90% of the railway companies and infrastructure managers we run have a risk profile that has been similar to Banedanmarks to begin with and then we run different versions. Right now I'm trying to start all over again and now I've got T. in from the airport, from aviation. And it is a completely new way of thinking about it, where we have then defined some risk on the individual activities. But it has to be connected in relation to the deviations, in relation to the action plans, in relation to incidents, etc. So I think that is actually difficult. Again, when we get into this with having to assess. We can read the requirement. We can understand that. We can understand the background of how we do in reality. And how do we make it complete. So in the end, how will the Agency approve that is ensures we are doing it right. And then the	Making a risk profile in an existing (running) operation, means that deviations/incidents/ actions plans/etc. must be considered and not only the activities. And the other way around.

	så også til at nikke til at det vi gør det det så er rigtigt. Så så risikoprofil. Og det her med at få afvigelser og handlingsplaner osv. til at i virkeligheden at fungere, som det er tænkt fra teori til praksis. Det er svært.	risk profile. And this with getting deviations and action plans etc to in fact work as it is intended from theory to practice. It is hard.	
A	Også uden at lave alt om?	Also without changing everything?	-
	Jeg er ikke bange for at lave det om hvis det var det der skulle til, men det er forståelsen og det er i det her med at det kræver en masse tid, papirtid. Så jeg plejer, og folk hader når jeg siger det men nu begynder de at få forståelsen, jeg plejer altid at snakke papir verden og den virkelige verden. Hvorfor er det papiret giver mening i den virkelige verden? Så det sammenhæng der det er jo bare så teoretisk at man som banemedarbejder måske ikke lige fanger, hvorfor det er vigtigt at han melder det her ind. Fordi går du ud og snakker med dem, så ved de jo alle sammen noget som vi ikke ved bag skrivebordet. Det er jo det, vi skal	I'm not afraid to redo it if that was what it was supposed to do, but that's the understanding and it's in this that it takes a lot of time, paper time. So I usually and people hate when I say that but now they are starting to get the understanding, I always tend to talk paper world and the real world. Why does paper make sense in the real world? So the connection where it is just so theoretical that you as a track employee may not just catch on, why it is important that he reports this. Because you go out and talk to them, they all know something we do not know behind the desk. That's what we need to remember,	Change is good when it is necessary, but the (amount of) paper work needs to be considered before making a change. The connection between theory and practice is routed in understanding the practical operations, so change is “correct”, and the system supports the activities.

	huske, at vi kan sagtens sidde og bygge et eller andet op bag skrivebordet, men det vil jeg ikke have. Så hele min sikkerhedsafdeling, de får at vide at de skal ud i driften, de skal ud at snakke med dem. Vi skal være kendte mennesker. Og så lægger vi simpelthen øret til vandrøret, og så så finder vi ud af, hvad det er. Så kan vi skulle gå tilbage og spørge dem der sidder ved deres skriveborde ude i infrastruktur, hvad handlede det om. Der begynder vi at have dem med igen, fordi vi kan systemunderbygge. Vi skal gøre det nemt, Vi skal give dem sammenhængen, men det er rigtig svært. Det det synes jeg du skal have med i den dér, at de fine tanker vi kan få det her og hele CSM-Monitoring det er svært. Det er rigtig svært også i forhold til leverandør styring, overvågning osv. Og risikoprofil.	that we can easily sit and build something up behind the desk, but I do not want that. So my whole security department, they're told they're going out into the operation, they should be out talking to them. We must be familiar faces. And then we simply put the ear to the water pipe, and then we find out what it is. Then we might have to go back and ask those sitting at their desks out in infrastructure what it was all about. There we start to have them again because we can support the system. We have to make it easy. We have to give them the context, but it's really hard. That's what I think you should include in it there, that the fine thoughts we can get here and the whole CSM- Monitoring it is difficult. It is really difficult also in relation to supplier management, monitoring, etc. and risk profile.	An SMS needs to connect theory and practice in a simple manner.

OL

Due to a technical difficulty, the interview with Odense Letbane was not recorded, and therefore no transcription is available. Condensation was consequently performed based on written notes from the meeting as well as the authors memory- see also section Source of errors. The interview was performed in Danish.

Question	**Notes**	**Condensation**
Which legislation is relevant for your SMS?	Certified according to 712, which is identical with European requirements	Certified according to 712
Metro / light rail: Is there a difference in the requirements for your SMS in relation to conventional rail?	Light rail does not differ from conventional rail. BoStrab is not a Danish legislation, but a German legislation, meaning that it can only act a technical input. Betriebsleiter is therefore not a function in OL. Safety regulations are a combination of 712 and 1608. 1608 ("*elsikkerhedsdirektiv*") has been added as safety regulation for traction/electricity instead of making specific technical rules for traction current instruction (kørestrømsinstruks) – this has made the traction current instruction much more compact compared to BDK, as OLs basically only contains respect distances. Other than 172 and 1608, the Road act (1710) is also applicable for light rail. This is though not a part of the SMS, but requirements that are built into the rules where necessary (e.g. traffical rules are based both on the technical system and road act).	No traction current instruction, as 1608 is managed externally from SMS/172. Road act (1710) is also applicable for light rail rules, but not as a part of SMS itself. 1608 and 1710 are managed as a part of the technical basis.

How (if?) do you distinguish the railway safety-bearing SMS with other requirements for a management system (employees' health, environment, quality, etc., e.g. according to the standards ISO 9001, ISO 14001, ISO 45001 or BS 8800)?	It is separated, outside the boundaries related to legal requirements (1608-1710, which is included where un-avoidable/necessary).	Separate SMS and other requirements.
Can you give me a review of the structure of your SMS? - Content / structure? - Format (processes, rules, etc)? - User interface (paper, web, program)? - Rules of use (e.g. no local copies)?	Based on requirements in 712; meaning that the basis is the system description (technical system and activities) and risk profile (based on system description) – in accordance with the NSA guidance. Visualized as a plan-do-check-act cycle, where the do-area contains instructions for traffic, planning, rolling stock and infrastructure. Requirements have been ensured by making a cross-reference-matrix. User face is: - app for practical users, web/laptop for office staff - SMS is a web-portal, text-based and (check)form-based. - Different users get different content (user group defined)	System description and risk profile is the basis for SMS. Plan-do-check-act cycle. Web-based platform (office) and app (operations). User interface is configured, and access controlled, according to user group to make sure one sees what they need.

	- focused on data quality by ensuring that data is reported accurately (e.g. you have to choose a place of an incident based on pre-defined areas) - data is connected to hazards meaning that incident reports can be taken directly out of the system without creating secondary documentation - is updated live (updates are pushed automatically), meaning that the newest process/instructions/etc. are always available. - actions are handled as action plans, meaning that the user does not need to remember actions, but they are stored in the system and gives alarms on actions Since operational staff works on an app (deviations, incident reporting, finding rules, etc.) Documents and other files/links are added to a process/action plan/etc. to keep All documents (internal) are kept in one place and links are added where necessary, to avoid duplications (everything is in 1, 1 process, 1 place, 1 document)	Everything is done on the platform/app, no paper or "we usually do". This is helped by being a new company, with no existing culture. Built-in traceability between operation/data and risk profile/mitigation measures ensures that data can be considered valid/not outdated. System is built "smart" so you cannot ad data that does not make sense + actions are reminded. Only 1 copy of everything; if placed several places it is a copy.
To what extent are the requirements for other actors' approvals built into your SMS	It is not separated, as Keolis have both infrastructure and operator. What can be kept as common across RS and INF, is kept as common.	User interface is configured, and access controlled, according to user group to make sure one sees what they need.

(RS, contractor certificates, etc.)?	SMS is shared with AAL (where Keolis is operator), so the user-interface for AAL will show only what is relevant for AAL end-users, etc. (permissions based on controlling user access, same as for OL staff based on their user-group)	
Are there any areas that, from experience, have been given a lot of focus (e.g. due to personal or organizational experience)? - for example. human factor, maintenance, etc.?	Positive that it is a new organization, meaning that safety culture and use of SMS can be built from scratch; no old habits to turn around. Everything is equally important, but traceability between requirements and actions/mitigation is key: No loose ends. One thing that is missing from SMS is the link between functional descriptions and procedures. This is currently done in Excel, but to ensure traceability and links in the system is global, it is a wish to add that to the digital system. OL being a light rail does not change the setup of the SMS compared to conventional rail – system description and risk profile is the basis either way. Through the traceability of hazards to procedures/actions/incidents, it is possible to manage reporting within the risk profile, i.e. if a hazard is triggered many times it can be seen in the risk profile, and it is possible to develop the mitigative measures to keep control of the risk. This is indicated through colour coding and arrows, that give a "live" picture of the trends.	Safety culture is important for the success of a SMS. All requirements are equally important, but traceability between requirements and actions/mitigation is key. The use of incident/deviation data within the risk profile as "live" updates, makes it possible to continuously monitor risks by making it possible to develop the mitigative measures to keep control of the risk.

	The approval overview and operational status (maintenance) are managed in the same view, meaning that rolling stock cannot be used if either/or is not ensured. The system is built in a way that the RS cannot be manned ("like a work order").	
From experience, have you encountered any challenges in building your SMS?	-	-
Has the size of your organization been a factor in building your SMS?	-	-
How do you handle SMS updates (changes technical / organizational, risk profile, technical rules, etc.?)	Change management through version control. A change overview can be accessed where change requests, incidents/deviations, actions plan are shown. Same form is used for all types of changes. All changes are reviewed according to CSM-RA (method for the entire system) – change review must include impact on other sub-systems/parts of SMS, e.g. a change of procedure or technical component needs to spark a review on new training. Since the SMS is form-/prose-based third parties can have copies of all relevant documents and instructions, meaning that there is less chance of confusion than if you have a swim-lane based system which requires access – in addition you don't need to update any	To keep control of the risk profile, through the system description, version control/change management in necessary. Keep it simple; use the same method and forms for the "same" task. But make sure that the method/form/process can cover it all.

	secondary documentation, that is given to external parties, when there are changes in the SMS (1 process, 1 instruction, etc)	"Only 1 copy of everything; if placed several places it is a copy" is also useful for exporting knowledge to third parties.
In addition to safety targets and reporting, do you use any methods to ensure SMS fulfilment of function (objectives)? - for example. KPI regarding maintenance?	-	-
Do you use any accredited certification schemes to ensure railway safety objectives?	-	-
If a common-basis approach existed when developing or updating your SMS, would you have seen advantages in using this?	-	-

- Why / why not?		
Anything I have forgotten, or is very important?	Make the plan before making the system. Structure and format needs to be defined before making the system, otherwise errors will sneak in. And since there is a safety approval that is needed for operation and people also get used to working in a system, it is difficult to change a structure, system and/or format.	Think the SMS through before execution of SMS.

Metro Service

Person (IM/A)	**English**	**Theme**
A	Maybe I should just use two minutes to tell you what the project is about. I've been working with CSM-RA for many years, working just with changes in infrastructure, and so I've tried to do changes on many different infrastructures and I'm always a little bit surprised on how different people do it. And then I'm doing my master thesis. So I figured, OK well maybe I could look at whether you could do some sort of common-basis for the infrastructure manager in terms of the SMS. That's basically the principle of the whole thesis; looking at whether it can even be done, and if it can be done in what degree can it be done, because all the infrastructure managers is of course different. So that's the thesis, that's it. It sounds very little, but I found out how much it was.	-
IM	No, I imagine that is huge.	-

A	I've done a whole requirement mapping in terms of the legalities from ERA and NSA, and so on, and the Danish legislation. But that's just what's on paper, and my experience is that best practice is always better than just doing what's on paper. And that's why I wanted to have these interviews with different infrastructure managers. I have a load of questions and I will try to keep it as short as possible.	-
A	So just to start off the legislation that is the basis for your SMS is that 172?	-
IM	Yes, the latest one. We just got it converted last year.	Certified on 172 since 2021.
A	And in terms of that one, is there anything else legislative you look at or is it 172 that is your basis?	-
IM	Yes, it's the basics.	Only 172 is relevant for SMS.
A	In your experience, is there difference between the requirements that that you need to live up to, in terms of conventional rail versus metro?	-
IM	What do you mean with conventional?	-
A	Long rails for example.	-
IM	I think there's always been squeezed a bit for because we are both infrastructure manager and railway undertaking, both roles, and we are a closed system. So this requirement about having an SMS for the system like us is fine. It's very fine. But it was a decision on Denmark. In Italy, for example they are starting now, but they didn't have it before. Or in another European country there's not this requirement, but I think all in all it was very fine. Yes, it's a management system. We have other management system. The structure is the same, so we're not putting another one above railway safety.	Requirement for SMS on closed system with both roles was a Danish requirement for MS-organization.

A	A management system can be many things, so have you divided your management system up or is it just one big system?	-
IM	We implemented first quality, now we have a new platform, I can show it to you. We have a quality management system which setting the frame from the other management system. Railway safety is coming into the quality management system, and the same for the health and safety, the same for the environment that we're working with. We work with energy, with IT, but we have a quality management system, a certified 9001:2015 and this is the frame for the other management system. So my assistant says, how do we do an audit, and then we you do an audit about railway safety you follow the guideline of the Quality management system. We do not invent a new way to carry out audit.	The railway SMS is based on a QMS. Integrated QMS, SMS and other management, all within frame of QMS. All processes follow the QMS-content (where possible), meaning that everything else is add-on.
A	Keeping it as simple (as possible)?	-
IM	Yes, that's it. So we have one procedure just to make it simple. One procedure to make audits irrespective when we do audit on railway safety, quality, environment, health and safety. We want to have an integrated management system. That's a bit disputed.	An integrated system can be seen as disputed.
A	Is there a reason for choosing that, some experience or?	
IM	It's a logic way. Instead of having five procedures for carrying out an audit as much as… the more integration the better it is in terms of streamlining the process, and also in terms of how many procedures you need to be aware of.	Having an integrated system is keeping is simple, and easy for the end-user to use.
A	In terms of building up your SMS, are you working on a procedure, or prose text-based or instructions?	-

IM	*SHOWS SMS ON SCREEN – IT'S VISUALIZED AS THE STYLIZED METRO LINES WITH DIFFERENT PROCESSES BING SHOWN AS STATIONS* This is what we have implemented. We have the metro; it is just visually just to make it interesting. We have the metro line and we have done all our core processes in this part. Developing business, Maintaining and operating the metro and serving customers. And then we have all the supporting processes, finance here in the blue line. And we have the management processes in the red line in this circle, and this is the Copenhagen Metro. And then you just click on a button, and you got it, it's divided in network and then you want to see how we perform maintenance. You click here and then you have a swim lane in which you see who's doing what. (There is) specific procedure if you want to do something, but this is what we have. We just developed this recently when we did the update to the latest bekendtgørelse. So it's a mix of network processes and also procedure instruction.	Built as a core/support process system, where core contains operation and maintenance. Partly uses networks, with processes shown in swim lanes, where role-actions are shown. Mix of network processes and also procedure instruction.
A	And how about the user interface, is that always web-based or do you need to go into a computer or?	-
IM	You need to have a computer, yes. And then you have some specific documents like for example functions here as a job description which are typically to be opened up in Word.	Web-based.
A	So for example when you go out and do maintenance, then I would take out a paper with me and do a checklist and then I would go back?	-

IM	Yes, but we are moving. We have two lines. This line is a bit of an older line in the sense that it was born long time ago and designed in 1996 (*referring to M1 and M2*), for the other one (*referring to M3*) we are using more iPads when doing maintenance in check scheme. And of course we want also to use the same also for the current metro.	Different setup between old and new lines. Old lines are paper-managed (in the field), new lines are digital (done one tablets). Migration to completely digital setup is a wish.
A	And also for the new on (M4)?	-
IM	Yes, we have all this iPads. Yes, it's much more IT based. On M3 it has just been launched.	-
A	Was it a choice to go IT-based?	-
IM	I think it was a contract requirement. But of course a very meaningful contract requirement, instead of using paper all the time.	Migration to completely digital setup was a contract requirement on the new line. Migration of the old lines is added on.
A	Because I do know that at Banedanmark, they do have some not so nice experiences with people doing maintenance on checklist, that's like very old.	-
IM	They are so big. Banedanmark is a much more complex organization, I guess.	Having problems with paper-based check schemes can be (partly) contributed to the size of an organization – too large company means that it becomes more difficult.

A	And I'm also guessing that the metro organization quite quote unquote new?	-
IM	Yes, this company started I think in 1998.	MS is from 1998.
A	So it's been quite easy to move the safety culture toward an IT-based?	-
IM	Yes, there was a strong safety culture in the beginning in Metro Service. It was a driverless Metro, so it was something new for everybody. So safety was put early in the front seat, sometimes even too much because at the end a metro is made to move passenger, it is not made to be safe. It moves passengers from A to B in safe way, but safety is not the ultimate goal of this company. It is moving passengers. But at the beginning, safety was even more important than the passenger, which either way was a bit heavy, but I think that's created or it has put the foundation for a good safety culture.	It is easy (easier) to change platform/ methods if a strong safety culture is in place already. While it can have negative consequences on operations/ business, creating a strong safety culture in an immature organization can make it more robust safety-wise until maturity has been reached.
A	So you had a heavy start and then you relaxed it?	-
IM	It is conservative and now of course we are becoming more mature. So I think we can change. While before, if there was some doubts let's go for the safety side without reflecting so much. Now I think we have much more experience to take some qualified decisions. Experience, we have more experience.	Maturity in an organization makes room for les conservative but still qualified decisions.
A	But you're still required to work with based, right? So if you if you do any sort of changes then you still need to do a risk assessment, right?	-

IM	Yes, we follow this safety approach. For me it's fine. We have had a configuration management system since we started. So we have traced all the changes. We have a register of the changes that we have done. I can tell you how many changes we have done since the opening in 2002 (*FINDS THE NUMBERS IN THE SMS*). We've done about 2100 changes since the beginning in 2002. Since the beginning, all the ones that we have traced, but there was a strong… we follow a standard, probably you know this CENELEC standard 50126 and in the V-model there is an activity at the end that is called modification and retrofit safety plan. When you go into operation we need to have a modification in the retrofit safety plan. So it's an important phase of this V-model and in this plan forced the Metro Service to set up a configuration management system. So from day one whatever change in metro service to documents, even to the organization was made, was traced to this configuration management process. So that's why we have so many. This is only for the old metro, from the new metro I cannot remember how many. But I remember from the old Metro we did 150 changes last year. For the new metro! 150 changes.	Configuration management is necessary to track changes. This is done through a process. EN:50126 V-model was used in the building phase, meaning that configuration management was enforced through a retrofit safety plan.
A	Does that include third parties and minor maintenance changes? If you switch a component to something else, so it's not huge.	-
IM	Third parties is onsite, yes. Authorized 150 is many; 115 cityringen and 15 to the system. Minor changes, it depends. There are also minor of course. So minor stuff, there's two changes of the signalling system in the cityringen we did twice last year.	Every change shall be managed through the configuration management.

A	So in terms of your SMS and how you build it, it is there anything that has been more difficult or less difficult? I'm thinking in terms of using it. For example, if… I think a good example, from one of the other people I talked to, is that it just doing changes in the system. So in terms of the organizational change, moving from one bekendtgørelse to another bekendtgørelse, that was actually kind of kind of difficult.	-
IM	The only things, moving from the old, from the previous one to the newest there was some new requirements there is this requirement about identifying non-conformities. This was a bit difficult to think how to do it. This will be a new requirement. I think it makes a lot of sense, but we had to study a bit, reflect a bit on how to address that. Because it really means that whatever happens, we need to find the right level and we cannot start registering "These are non-conformities" because then it will be too much for the organization. So we had to set the correct bar that make some definition, not completely precise, but at least there is a definition and then start working on this. That was I think a new requirement that caused a bit to reflect. Apart from that, I think it's always, the rest is more or less the same. The other is the requirement about the safety monitoring. That was also something that we had to reflect a bit.	The switch from 147 to 172 added new requirements to the SMS; non-conformities and safety monitoring. New requirements should be reflected before implementation. Non-conformities are tricky because it needs to be defined, for setting a bar for action, in order to not stress the organization with too many deviation registrations.
	New requirements are always tricky?	-

IM	Yes, but it's also interesting because there are actually some meaning to it. I can see there is a logic, if they're used in the right manner they can give value, so it's fine.	The requirements given in 172 makes sense but needs to be used in a manner that creates value.
A	And how about in terms of just the normal day-to-day use?	-
IM	Our platform is new, is completely new, so there is still an implementation path and familiarization with colleagues that they that we are taking care of. Yes, there are some areas of the organization where they're not really aware of how to use it. And I have a role, and how can I find what I need to do? There's lot of people that know exactly what they do, so that's why. We are pretty aware that hey, what you do now is described here. So this is what we are working with. More implementation of the system there.	Implementation of a platform takes time; people need to be made aware that they/their function have a role/are described in the system.
A	And is that then more related to just understanding the system and how to use it, or is it more related to actually being able to use the system?	-
IM	It's more, for example, first of all there exists a process which describes what I'm doing exists in Minerva. I think everybody knows it called Minerva, our integrated management system. Everybody knows that this system exists, but I think they don't know that some processes they're following, those are now described somewhere. So that's why I think it's more an awareness that what's inside our system? How to use it I think is quite straightforward, it's very user friendly.	If a system is user-friendly, the use of it does not give major issues. Implementation of a new system is a question of creating awareness of the system existing “for/with you”.
A	So it's more question of getting people to go and see I'm going to do activity a), I'm going to go and look and see how to do activity a)?	

IM	Yes, I know how to do it, but if I in case I know that now it's described somewhere if I do not remember or if I need to ask a new colleague “look at that”.	No major changes was done for the new platform, meaning that it was already “done”, but now it is described as well.
A	What about the size of the organization? Did that have an impact on how to build and think your SMS? Because you're not the smallest but you're not too large as well.	-
IM	No, I think not. Not so much. We had an SMS covering this line (*M1 and M2*). We had to expand the SMS to cover the other line (*M3*). But it's more of the same. There were some new competencies because the system is technologically different, but extending the SMS was not a huge user exercise. To be honest.	The basis of an SMS does not consider size of company when the activities are the same. Technological differences can add new competences, but not new activities (overall). Extension of an SMS to more of the same is not a major user exercise.
A	And if you were to do a new SMS would consider… (*the size of the organization*)?	-
IM	A new SMS.. Now we will have a tramway, so we might want to do a new SMS actually for the tramway instead of extending the one we have, That is suggested here.	Internal MS-considerations on whether the addition of tramway to MS activities creates a need for new SMS (for only Ring3).

A	Would you then consider anything about organizational size in terms of what you would do in size, in format of SMS or?	-
IM	I think that... Present maintenance of the vehicles. We do, we have a new order (work order). We have a process which generates work order, so it's a bit, we can have 100 vehicle, we can have 10 vehicles, so 50 technician, another technician, it doesn't change that much in the SMS. Also to plan maintenance. Is this still the same however?	The basis of an SMS does not consider size of company when the activities are the same.
A	And implementation would be the same as well?	-
IM	It would be the same, of course. Of course it's more people to be trained, but it's more the same then it doesn't really have an impact on the size of the SMS as I see it. Of course, if you have handled vehicles in their own different, then maybe different competencies, maybe different profiles in terms of job description. But for us is really more of the same. So it doesn't impact so much the size of the SMS.	The basis of an SMS does not consider size of company when the activities are the same. Technological differences can add new competences, but not new activities (overall).
A	So it would maybe be fair to say that it's more the activities than it's… (*the organizational size*)?.	-
IM	Yes, the SMS as it looks now, I think the size would be the same if it was just for the model two or three and four and both of them. It doesn't really change.	Activities rather than size of organization defines the needs/size of an SMS.
A	You just have to follow the legal requirements and….	-

IM	In terms of the processes to be described is the same because the way we do maintenance here, is the way we do maintenance on the cityring, and it will be the way that we will maintain if we take another line. More or less with some changes, but doesn't impact the size of this, as I see it.	Processes is the same for all additions (i.e. maintenance might be done differently on different technology, but the process is the same – it is the procedure/instruction that is different)
A	So it would be safe to say that keep it simple, but it would still be the same?	-
IM	That would be the same, yes. Maybe a small change for some activities if there is something very different, but in terms of description of the processes is the same.	Even a change in activities would not necessarily change the processes themselves, but rather the content of the processes (and/or addition of further processes or duplicate processes due to e.g. several types of technology)
A	You mentioned something about having a certified SMS?	-
IM	No, I didn't mention that. We have the certificate, the safety authorization from Trafikstyrelsen. We have the ISO certification, 9001. We are certified, yes.	QMS is ISO certified.
A	You're not leaning on being certified, you're leaning on the NSA approval basically?	-
IM	For the SMS is the NSA approval. The quality management system which is the frame for the other management systems has been certified.	NSA is the (only) SMS approval.

A	Does that impact each other in any way? Good or bad? Or it's just two different things?	-
IM	No, they are integrated together, but yes, there is no, I think that Trafikstyrelsen is happy to know that we are certified ISO9100, I guess.	As QMS is the basis for the SMS, the system requirements for ISO:9100 and BEK172 are integrated. There is no impact between certification and safety approval, but it is not a negative thing to be ISO certified (QMS).
A	But you would get the SMS anyway if the system was OK?	-
IM	Yes, they're independent anyway, but 9001 is the foundation for all, also for the SMS. I think it's difficult, like would be difficult for me to understand, that a company and safety management system, but not the quality management system behind, supporting SMS. That will be an illogic approach.	Experience that it is illogic to have a non-QMS-supported SMS.
A	I think I understand why, but could you expand?	-
IM	Because if you don't have.. the SMS is just more requirement compared to the requirement of the quality management system. Quality management system, the standard one is there's some German requirement and bekendtgørelse is leaning against that. There is even a table. So if you don't have a good foundation I don't know how you can just implement an SMS in a company without something that is supporting the business behind as a...This is my personal opinion. I couldn't see	An SMS in itself does not support business and does not contain/ support an organization but is “just” a set of safety requirements.

	how to implement an SMS without adding a QMS behind. It's the backbone of organization systems.	
A	So basically the idea of having a railway safety management system in itself alone would not cover enough, basically.	-
IM	I think it would be a strange because it is strange approach. SMS is something we have already in the business world, but maybe some odd company they would.	QMS already contains parts of SMS.
A	I think there's a lot of difference on how it's tackled, because I've seen both very independent and split, but also seem very integrated at this point. And it sounds like yours is the most integrated at this point.	-
IM	I think it's the wisest solution, they should go hand in hand all the management systems. It's also much clearer for the employees here to know that this is the way. As I see it, but of course, one might have then need to implement the SMS to get the certificate and they take care of this address. Business then is… yeah, it's also fine, but if you have time I think you start with the QMS and then you reflect on implementing it and then you start integrating with the management system.	Experience that the integrated solution is best, as it is clearer for persons how and when to use it (understand the use of it). SMS is required for getting a safety approval, but not in itself a goal/enough. Reflection of implementation of SMS (either stand-alone or integrated) is key.
A	And that's to both give a framework, but also support business basically.	-

IM	Yes. SMS just for the sake of SMS I don't think it makes so much sense. I think it's much more understandable by the organization. If you… yeah, never mind, but there are of course there are different needs in different company. I think we choose that one. I think that was our choice and it worked fine for us both the QMS and then all the other, including SMS.	"SMS just for the sake of SMS, I don't think it makes so much sense". Having a QMS as basis for SMS can create "sense-making" of the SMS. Different companies have different needs.
A	In terms of, because now you're an integrated operator and infrastructure manager, so when you have this integrated system, does that also mean that all the all the different legal requirements that we have in in the different roles are kind of mixed up in the whole system?	-
IM	I think we have the same legal requirement. We don't have so many different requirements, no.	Requirements as infrastructure manager and railway undertaker is seen as same.
A	No, it's not that different. But for example, I think the infrastructure manager would not be required to have rolling stock.	-
IM	No, I think if I asked someone they don't even know. Or that this difference in the company that we are most infrastructure and it's really mixed. It's really put together, yes.	In MS, staff would probably not be able to tell you that a requirement was manifested due to the role as infrastructure manager or railway undertaker.

A	So whether you're doing maintenance on a track or maintenance on a rolling stock, it would be the same basis?	-
IM	Yes, the process describing maintenance for rolling stock and track is the same. it's the same process. We have been actually reflecting if we should make it go a bit at the lower level and splitting up planned maintenance for rolling stock and planned maintenance infrastructure management and there is a task force now analysing this. But up to now the process about planned maintenance is the same.	Overall the process for maintenance in the role as infrastructure manager and railway undertaker is the same. Recent discussions if the procedure/instructions between infrastructure manager and railway undertaker maintenance differs enough to create the need to split the procedure into one for each type of maintenance.
A	And the purpose of splitting it would be to simplify it for one part or?	-
IM	It's because one we would like to do this, we go a bit more into details about how we do these two things. Now we are we are setting back to a certain level, so it's fine to have this process common, if we go a bit more in details if it makes sense, then it could also make sense to split it because there are some small differences on how to do it. Right, so it's just a choice, but it's maintenance, it's our colleagues that are taking a decision. If it makes sense, it's not for me, it's if it makes sense for them. For me, as long as they know what they need to do and it's fine. But then they need to take it. They're designing it to what way to take it.	The split of process would be due to different needs for the types of maintenance (how to do it). Setup made with involvement from actors in the areas, to ensure the process/instructions is best possible for the actors.

A	Basically I'm hearing you say that that the interface and look of an SMS and function of an SMS also needs to be defined according to whatever organization you have and that needs.	-
IM	Yes. It must in a way, yes, adapt to the organization, also to the safety culture of the organization too.	Safety culture and the needs of the organization is the basis for the user-interface as well as structure of the SMS.
A	Is there anything really important or really tricky that I haven't opened up about talked about, asked you about that I should consider?	-
IM	You mean infrastructure manager role specifically regarding general?	-
A	In general, in relevance to the SMS and function and so on. Or the build could also be relevant.	-
IM	No, I don't think so. Not answered immediately.	-