

UiO : **University of Oslo**

# **Applying Models for Safety Climate on Rail Traffic Management**

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May 2011



## Acknowledgements

I would like to thank my supervisor Cato Bjørkli for nurturing my interest in human factors, and for sharpening my mind by continuously pushing me beyond my comfort zone.

Thanks to my fellow students in “Lesesalen vår” for contributing to a supportive study environment. Special thanks to Georg Giskegjerde for setting a good example in his dedication to the thesis. Our academic discussions have been a great challenge and will be one of the things I will miss most about the thesis work. Additionally Georg, as well as Lars-Martin Berglund and Silje Henriksen, deserve credit for having assisted me towards a reliable data treatment. I am grateful to Anne-Linn Heldens Forbord, Fredrik Asmaro and Judita Averkaite for useful feedback on earlier drafts of this thesis.

Thanks to Bjarte Knappen Røed for sharing his insight in the human factors field, and to Scandpower for providing a desk at their office during my thesis writing. I would also like to thank Kjersti Myklebust and Øyvind Gurholt in the Norwegian National Rail Administration for a very positive response to my call for informants.

I owe my parents a lot for having encouraged me throughout all these years of education. Had they not risked their lives to escape from Iran I would have been barred from higher education because of our religious beliefs. Throughout my work I have been motivated by my responsibility to live up to the possibilities that my fellow youth in Iran are denied. Therefore I would like to dedicate this thesis to the Bahá'í youth of Iran.

Finally, I am thankful to God for all of the above.

Asker, May 2011

Sasan Zarghooni

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## Abstract

The Norwegian railway is under pressure of increasing traffic. As a way to document the results of its safety management system, the Norwegian National Rail Administration has decided to measure its safety culture annually. However, there are no safety culture frameworks that have been validated for the railway domain. This study tested the ability of two safety climate models to account for safety climate among rail traffic controllers (RTCs). 15 semi-structured interviews of Norwegian RTCs from three rail traffic control centres were conducted. The interview transcripts were unitized into 1363 statements and coded in Flin, Mearns, O'Connor and Bryden's (2000) Safety Climate Model (SCM) and Ek, Akselsson, Arvidsson and Johansson's (2007) Safety Culture in Air Traffic Control (SCATC). The results indicate that none of these models account completely for the safety climate among RTCs. SCM and SCATC were combined in a big model, but there was still a significant residual. A thematic analysis of the residual from the combined model showed that 35 statements added new themes to the safety climate framework. This implies that a framework for safety climate in the domain of rail traffic management cannot be entirely based on the examined models.

## Applying Models for Safety Climate on Rail Traffic Management

The Norwegian railway is under pressure to satisfy an increasing need for efficient transportation. For the past few years the capacity of the infrastructure for rail traffic production has been fully exploited, occasionally beyond what is acceptable in terms of safety barriers (Jernbaneverket, 2009a; Lepperød, 2007). This requires more interaction between stakeholders and less flexibility of action, and therefore puts pressure on the socio-technical system of the railway industry. According to Dekker (2005) accidents in very safe organizations occur when the organization becomes used to a more demanding situation without adapting its work practices or technology sufficiently to the new needs. Thus a system under pressure may drift towards an accident (Dekker, 2005). An example of how this may happen is the Sjursøya accident. Due to increased traffic production the goods terminal at Alnabru was not being used in accordance with the intentions behind its design (Accident Investigation Board Norway [AIBN], 2011). On 24<sup>th</sup> March 2010 sixteen empty cargo cars were released onto the main track due to a misunderstanding between the local train dispatcher and the shunter. After several failed attempts to stop the cars, the rail traffic controller (RTC) directed the cars towards the harbour at Sjursøya. The cars derailed and hit the harbour building which collapsed, killing three and wounding four. After the investigation of the accident, the AIBN concluded that one of the factors that made the accident possible was bad safety culture, especially with regards to sharing information across organizational units (AIBN, 2011).

It is not only in the Sjursøya accident that safety culture has played a role; it has been a part of The Norwegian National Rail Administration's (JBV) strategy since 2008 (Jernbaneverket, 2009b). Norwegian regulations require JBV to apply for safety clearance from The Norwegian Rail Authority ("Jernbaneforskriften," 2010, §7-1). The JBV currently operates on a 3-year trial clearance which expires 1<sup>st</sup> July 2012. A continuation of the clearance depends on whether they are able to document that safety in the railways has improved (Rolfsen, Oltedal, Hauland, Øie, & Rodt, 2010). One of the focus areas of the JBV is documenting improvements in the safety culture among its employees (Rolfsen, et al., 2010). This is consistent with Bailey and Petersen's claim that safety climate surveys can "identify improvements in and deterioration of safety system elements" if they are conducted periodically (Bailey & Petersen, 1989, p. 26). Because safety culture is such an integral part of the safety management system of the railway industry it is important to have a valid

measure of relevant safety culture dimensions<sup>1</sup>. Safety culture is therefore a highly relevant and critical topic for Norwegian railway today.

RTCs, who are the people in charge of what happens on a railway stretch, are daily in contact with most groups that influence the railway directly, such as train drivers, train conductors, maintenance workers, construction contractors, and operating companies. This gives the RTCs a broad view over what is going on at the sharp end of the railway industry. Additionally they are measured on punctuality by the higher management, and this adds another factor in deciding on what to prioritize. In short, RTCs have an overview of the situation on the tracks, and they prioritize safe versus efficient production in accordance with the organization's principles and the workers' requests. Therefore RTCs have one of the most influential jobs in safety management in the railway industry, and a safety climate assessment among them will provide a nuanced representation of the actual railway safety.

Although the JBV is using safety culture as a benchmark, and RTCs are an integral part of railway safety, there have been no published validation studies for safety culture among RTCs. In fact, there is hardly any research available on safety culture in the railway industry (Sten & Fjerdingen, 2003). An exception is SINTEF's report on safety culture in European rail interfaces (Johnsen et al., 2003), which is a review of safety climate work relevant to the railway industry. Additionally, Det Norske Veritas has assessed the safety culture in JBV (Rolfsen, et al., 2010), but the report does not add anything new to the validation of safety climate literature across industries.

Considering that there are no models developed specifically for railway safety climate, and that safety culture is a pronounced priority of the JBV, the lack of empirical documentation of safety climate models for the railway domain is a major concern. It is not a simple matter to transfer a model from one domain to another, as this could present a misleading picture of the safety climate (Cox, Tomás, Cheyne, & Oliver, 1998). Therefore it is important that human factors researchers test existing models for the railway domain. The following sections will present some of the relevant theoretical issues as well as two models that will be tested.

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<sup>1</sup> No distinction is made between safety culture and safety climate in this paper.

## Theoretical background

### *Definition of safety climate*

Safety climate is a way of assessing the safety level of a site, and is defined as workers' shared perceptions of and attitudes towards safety of their work at a given time (e.g. Mearns & Flin, 1999; Zohar, 1980). Several studies have attempted to improve the reliability and predictive validity of safety climate by connecting it to accident data (see Mearns, 2009; Silva, Lima, & Baptista, 2004; Zohar, 2010). Safety climate is primarily measured using questionnaires and interviews (O'Dea, O'Connor, Kennedy, & Buttrey, 2010). According to Zohar and Luria (2005) safety climate is one of the facets of organizational climate. The term safety climate is sometimes used interchangeably with safety culture. However, Rousseau claims that culture and climate are sufficiently similar for "research on one to inform us about the other" (Rousseau, 1985, in O'Dea, et al., 2010). For the sake of consistency the term *safety climate* will be used in rest of the thesis. A more thorough account of the distinction between safety culture and safety climate can be found in Guldenmund (2010).

### *Generic or domain-specific?*

There is still some uncertainty regarding whether safety climate is generic or domain-specific. This gives a reason to test whether safety climate in the railway industry is different from safety climate in other industries. There have been attempts to create a generic factor structure for safety climate through reviews of existing surveys (e.g. Flin, Mearns, O'Connor, & Bryden, 2000; Guldenmund, 2000). However, researchers have had difficulties replicating factor structure across industries. For instance, Cox et al. (1998) found that factor structures of the same survey varied between industrial gas workers and workers in the manufacturing sector, suggesting that safety climate is domain-specific. Obviously survey items have to be rewritten for the specific industry, as it makes no sense, for example, to ask an air traffic controller about the availability of life boats. When applying a safety climate framework from one industry to another, one of the important issues to consider is whether rewriting items is sufficient or whether a thematic adaptation is needed.

There are several ways to develop a safety climate framework for an industry that does not already have one. For instance, the new framework can be based on a generic *one-size-fits-all* model, on a model from a domain with a similar environment and similar tasks, or on a

combination of a generic and a domain-specific model. The next section will describe the two models that will be tested on rail traffic management<sup>2</sup>. The first is a generic safety climate model based on secondary sector industries. The second is a domain-specific model developed for air traffic management.

### *Safety Climate Model*

Flin and colleagues (2000) review of safety climate surveys has become a milestone in safety climate research. They reviewed 18 safety climate survey reports to identify common themes that constitute a unifying theoretical model for safety climate and arrived at five common themes. The strength of their safety climate model (SCM) as a generic model is that the review is based on surveys from several industries, mainly from the energy, petrochemical and manufacturing industries, and that it has been validated in other studies. For instance, Imset (2008) and Salvesen (2008) have showed that 80% of what employees in one shipping company said could be described within the SCM framework. Furthermore, it features as the main framework in the most recent literature review on safety climate (O'Connor, O'Dea, Kennedy, & Buttrey, 2011). The themes of the SCM are described below. When nothing else is indicated the definition is based on the review of Flin and colleagues. The operational definitions of the themes used in this study can be found in the coding manual in Appendix A.

1. *Management/supervision* covers perceptions of the management's attitudes and behaviour related to safety, production and other competing topics, as well as the role of supervision in preventing accidents.
2. *Safety systems* covers systems explicitly directed at safety, such as safety personnel, safety policies and procedures, technical authorizations, and safety equipment.
3. *Risk* can be divided into three sub-concepts: risk perception, risk tolerance, and self-reported risk taking. Risk perceptions are directed at general hazards on the worksite (Flin, et al., 2000) or at particular activities and situations (O'Dea, et al., 2010). Risk tolerance is about how willing a person is to engage in risky behaviour in the future (O'Dea, et al., 2010). Self-reported risk-taking is about how far the workers are willing to set aside safety.

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<sup>2</sup> In this thesis *rail traffic management* refers to the domain, whereas *rail traffic controllers* refers to the workers.

4. *Work pressure* is about high demands, especially in combination with a lack of time and resources.
5. *Competence/training* is characterized by the workforce's perception of the general level of qualifications, skills and knowledge. This category encompasses both technical skills and "soft skills". A subcategory of competence is training.

Additionally, Flin et al. suggest including *Procedures/rules* as a sixth category based on Guldenmund's review (Guldenmund, 2000). This category refers to the attitudes towards safety rules and procedures, and the level of compliance to them. They also mention two more themes, *blame* and *organizational learning*, without providing any definitions or empirical support for them. Blame is about how guilt is distributed after accidents (Imset, 2008), and Organizational learning is about how the organization learns from experience.

Applying the categories of the SCM to rail traffic management is one way to develop a theoretical framework for safety climate. However, when applying a generic safety climate model to a new domain there is a chance that one overlooks domain-specific themes. In order to reduce that chance one can use the same approach with a domain-specific safety climate model. In the following section a domain-specific model for air traffic management is presented.

### *Safety Culture in Air Traffic Control*

According to Cox et al. (1998) using a model for another industry than it was made for can be problematic. Therefore, domain-specific models of safety climate should be as similar as possible to the domain they are going to be adapted to. Due to its similarity to rail traffic control, air traffic control may be a good sector to look for a safety climate model. Both air traffic controllers and RTCs direct traffic remotely, their work is at times very intensive, and an error can have fatal consequences. Therefore their work is highly regulated with a focus on safety. Another reason to look towards air traffic control is that as opposed to rail traffic management there has been much research on air traffic control centres, including research on safety culture (see O'Dea, et al., 2010 for a thorough review).

Ek and colleagues have developed a safety culture questionnaire for transportation, and adapted it to air traffic control (Ek, Akselsson, Arvidsson, & Johansson, 2007). In this paper this representation of safety culture will be referred to as Safety Culture in Air Traffic Control (SCATC). The categories of SCATC are originally intended as a practical framework from which to choose or develop questionnaire items (Ek, 2006). The first four of the

categories listed below are based on Reason's criteria for an organization with good safety culture (Reason, 1997, in Ek, et al., 2007). The rest of the categories of SCATC are based on a selection from empirical research. The operational definitions of the categories used in the coding can be found in Appendix A.

1. *Learning culture* is about the organization's way of learning, e.g. through collecting and analyzing information. An organization with good learning culture is proactive in its approach to safety. According to Ek et al. the point of measuring safety climate is to maintain a learning organization (Ek, et al., 2007).
2. *Reporting culture* is a culture where employees report incidents and anomalies with the intention to support organizational learning. Reporting is a way of being proactive in the safety work.
3. A *just culture* is necessary in order to have a good reporting culture. If reporting is felt like informing against one's colleagues this will undermine good safety culture. A good safety culture requires that employees feel that they and their colleagues will be treated with justice if their name is connected to a report. The level of perceived justice can therefore be assumed to affect the quality and quantity of what is reported.
4. *Flexibility* is the organization's ability to use staff resources efficiently, including employees' ability to take over another person's tasks. Another aspect of a flexible culture is respecting other workers' knowledge and skills.
5. *Work situation* is about aspects that affect the employees' performance. This category is so extensive that it could be possible to divide it into several sub-categories. The definition includes psychosocial and physical work environment, receiving adequate education, as well as cooperation and the state of the technical equipment.
6. *Communication* is about various aspects of communication in the daily work. It comprises communication within their own team as well as with people outside this team.
7. *Safety-related behaviours* is about the behavioural aspect of people's relationship to safety, e.g. compliance with safety rules or taking shortcuts that compromise safety.
8. *Attitudes towards safety* is about individual and organizational attitudes concerning the importance of safety. In practice it is difficult to know whether a statement or item belongs to this category or to safety-related behaviours.
9. *Risk perception* is similar to Risk in SCM. The only difference is that *Attitudes towards safety*, which is a part of Risk in SCM, is a separate category in SCATC.

As previously mentioned no theoretical framework has been validated for use in rail traffic management. This section has described a selection of the relevant literature, including a generic model and a domain-specific model for safety climate. The next section outlines how these two models will be tested in the domain of rail traffic management.

### The present study

This study is about whether the thematic structures of a generic and a domain-specific model correspond with how RTCs describe the safety climate in their workplace. Safety climate is understood as the shared perceptions of the safety status in relation to the organization unit's work at a given point in time. The power of the models to account for safety climate is mainly investigated in terms of the number of statements that can be coded in the models. The purpose is to provide empirical support for whether the models can be used in the rail traffic management domain. The research question of this thesis is:

Are SCM and SCATC able to account for the safety climate among rail traffic controllers?

The question will be answered by testing the four alternatives of developing a framework for safety climate in rail traffic management. These are to apply a generic model, a specific model, or a combination of these two on a new data set, or to do a bottom-up analysis of the data.

Proponents of generic safety climate models claim the factors of safety climate are the same regardless of the industry (e.g. Guldenmund, 2010). Flin et al.'s SCM is one such generic model, as its categories are based on surveys made for different industries. If safety climate in rail traffic management is generic, the generic model in question should be able to account for all statements made in response to the interview questions.

Hypothesis 1: There is no significant difference between the number of statements accounted for by the SCM and the total number of statements.

Opponents of an all-generic safety climate model claim that the safety climate in some industries consists of dimensions that are less relevant for other industries. Therefore they

develop safety climate assessment tools for a specific industry, such as the oil industry or nuclear reactors. If safety climate in rail traffic management has specific dimensions, these are likely to be picked up by a framework made for a domain with a similar environment and similar tasks, such as air traffic control. Ek et al.'s SCATC is one such framework. If it is applicable to rail traffic management SCATC should be able to account for all statements made in response to the interview questions.

Hypothesis 2: There is no significant difference between the number of statements accounted for by the SCATC and the total number of statements.

If SCM and SCATC cover different aspects of safety climate, a combination should account for more statements than what the models do separately. A combined model may therefore be better suited as a safety climate framework for rail traffic management. Therefore, the combined model will be tested in a similar manner as SCM and SCATC separately.

Hypothesis 3: There is no significant difference between the total number of statements and the number of statements accounted for by SCM and SCATC combined.

A limitation of the previous approaches is that they cannot account for any statements that do not fit the predefined categories. With those approaches alone it is not possible to know whether these residual statements are relevant or irrelevant to safety. Because there is a possibility that statements may be relevant to safety and still not fit either of the models, the residual from the combined model will be examined thematically.

Hypothesis 4: Statements that are not covered by any of the models have no relevance for safety climate.

## Method

### *Participants*

With the help of local contact persons 16 RTCs (13 males, 3 females) were recruited from three rail traffic control centres in Eastern Norway. One interview (male) had to be discarded due to voice recorder failure. The remaining informants had a mean experience of 9.0 years ( $R = 0.5 - 21.0$ ,  $SD = 6.9$ ) with train control. They were between 32 and 63 years old ( $M = 44.3$ ,  $SD = 9.5$ ) and had been in the company for between 3 and 27 years ( $M = 14.9$ ,  $SD = 10.6$ ). One informant was not an RTC but a power supervisor. Due to the informant's experience and close cooperation with RTCs he/she was included in the sample.

All interviews were conducted between 9<sup>th</sup> and 30<sup>th</sup> November 2010 except for one on 28<sup>th</sup> January 2011. They lasted on average 24 min 25 s ( $R = 12 - 41$  min,  $SD = 10$  min 2 s). During the interview period in November there were no large-scale irregularities (e.g. accidents, strikes, extreme cold) that could have influenced the informants to discuss certain themes in particular. About one month before the last interview there was a bomb threat against a train that goes through the last informant's area, but there is nothing in the data to indicate that this affected his/her response.

### *Data gathering: SWOT Interviews*

Participants were interviewed one-on-one in an empty office at their worksite during calm hours of the day shift. The interviews were conducted in Norwegian following a SWOT approach. This is a semi-structured interview technique where the main questions revolve around the strengths (S), weaknesses (W), opportunities (O), and threats (T) related to the topic in question. A question is formed by connecting one of the four SWOT elements to the topic, e.g. "What do you consider the *strengths* of the *current safety climate* of this traffic control centre?" (for interview guide, see Appendix B). SWOT questions are open and assume as little as possible about the topic of interest, thus inviting the informants to provide their own personal reflections.

The questions developed for this study were concentrated on the informant's personal opinion of the safety climate at their rail traffic control centre. Such a focus on a defined experience was considered necessary in order to reduce the likelihood of interviewees talking about other safety-related topics. Focus does not contradict the principle of open questions; it simply encourages the informant to speak freely while sticking to the topic of interest (Handgaard, 2008).

The purpose of the data collection was to identify the themes that constitute RTCs' perception of safety, i.e. the safety climate. SWOT interviews were considered an appropriate qualitative approach for three reasons. Firstly, it is sensitive to the interviewees' current level of reflection. It elicits the "here-and-now focus of the interviewees" (Hoff et al., 2009, p. 10). As mentioned earlier, safety climate is the shared perceptions of and attitudes towards safety at the time of measurement. Hence, there appears to be a good conceptual fit between the mental and temporal aspects of safety climate, and the ability of SWOT interviews to capture such aspects. Secondly, the open-ended and focused questions of a SWOT interview encourages informants to reflect independently while maintaining focus on the concept that the models try to capture. Hoff, Straumsheim, Bjørkli and Bjørklund (2009) have shown that SWOT questions that are focused on climate elicit answers that are equally focused on climate. This will help uncover domain-specific or even generic themes that have not been covered by the models. When testing a model's ability to account for safety climate one must avoid asking questions that address the categories of the model directly. Otherwise there is a chance that the data are contaminated by social desirability bias. Therefore the interview must be open-ended and independent of the model it is meant to test. Thirdly, this interview technique and its accompanying analysis method have been used to validate climate models before (e.g. Hønsen, 2010; Imset, 2008; Salvesen, 2008), including validation of Flin et al.'s SCM (Imset, 2008; Salvesen, 2008).

The approach used in this study is quite different from the typical survey-driven validation. The strength of the survey this approach is that it can be used to confirm item loadings in a factor analysis. However, the conclusion about the factor structure of safety climate is limited by the items and dimensions already included in the actual survey. In principle, relevant dimensions can easily be overlooked, especially domain-specific dimensions. One way to check for overlooked dimensions is to interview workers from the specific domain, who are in a good position to understand what affects safety in their work environment. The kind of interview used in this study is therefore a valuable addition in the methodological triangulation to test the validity of safety climate models in other industries.

### *Analysis*

*Transcription.* The interviews were recorded and then transcribed word by word from where the interviewee began answering the interview questions. Hesitations and stuttering were excluded to preserve clarity of speech. Interruptions, demographic data, and names were

not transcribed. After transcription, the transcripts were checked against the audio tapes repeatedly until a correct rendering of the data had been ensured.

*Unitizing.* Transcripts were unitized into statements in a thematic way, which means that the boundaries of a statement is defined by where meaning starts and ends (Krippendorff, 2004). A statement was defined as the smallest meaningful unit that expresses a coherent, separable point of view. A statement had to be small enough to contain only one theme, yet large enough to be meaningful. A shift in positive/negative or temporal focus was indicative of a new statement. Consistent with previous research on organizational and safety climate, a statement could be “a part of a sentence, a whole sentence or several sentences” (Hoff, Flakke, et al., 2009, p. 7). The reliability of the unitizing was also assessed (see Results).

*Filtering of statements.* Statements that were *clearly* irrelevant to the topic of safety climate were excluded from the analysis. This was done in order to maintain a focus on safety. A statement was included in the analysis if it was about an aspect of the informants’ worksite or daily work, about the railway industry, or in any other way related to safety.

*Coding.* All statements were coded in SCM and SCATC. Each statement could be coded only once in each model. If the statement did not fit the categories of a model it was coded as a residual in that model. Because a consistency of definitions across studies is necessary to preserve a foundation for comparison with other studies, the operational definitions of the categories were based only on definitions in available research. A detailed definition of all codes can be found in Appendix A.

A fellow student coded 157 statements in SCM in order to assess the interrater reliability. Some instructions were given, but training was not deemed necessary as he used the same model in his own master’s thesis. Due to time limits interrater reliability was not measured for SCATC.

*Thematic analysis.* A thematic analysis was conducted to investigate whether the coding residual from the combined model was of any relevance to safety climate (Hypothesis 4). According to Braun and Clarke (2006) thematic analysis can be done either inductively (data-driven) or theoretically (top-down). A theory-driven approach was not possible as residual statements per definition do not fit the models. Therefore the thematic analysis had to be data-driven. Another characteristic of thematic analysis is that it can be either interpretative or semantic. An interpretative approach seeks to uncover latent meaning, whereas a semantic approach is superficial and is better suited for descriptive analyses (Braun & Clarke, 2006). The semantic approach was considered most suitable, because the purpose of this study is to test the descriptive ability of the models and not to understand the reasons behind RTC’s

perceptions and behaviour in relation to safety. In summary, a data-driven, semantic thematic analysis was considered the most appropriate for the analysis of the residual statements.

The thematic analysis was conducted in line with the procedure recommended by Braun and Clarke (2006). They recommend that a data-driven analysis consist of familiarization with the data set through several read-throughs; identifying interesting aspects by attaching one or several codes to each statement; clustering codes into themes independent of the statements; reviewing the themes against the statements for internal consistency and reallocating statements to new themes as needed; and, finally, defining and naming the themes (Braun & Clarke, 2006). The end result of the thematic analysis, the themes, were on the same conceptual level as the categories in the safety climate models.

### *Ethical considerations*

Negative effects of the interviews on the life and health of the informants were considered to be non-existent. Care was taken to treat the informants with respect, and to preserve their integrity.

*Informed consent.* All participants were informed before the interview, orally and in writing, that participation was voluntary and that they could withdraw from the study for any reason and at any point in the study (see Appendix D).

*Voice recorder.* Permission was obtained from all participants to record the interview with the purpose of ensuring the quality of the transcripts. The participants were informed that only the research group would have access to the sound files and transcripts, and that the sound files would be deleted upon conclusion of the master's thesis project. They were further informed that the transcripts may be kept in anonymized form for future research.

*Confidentiality.* The participants were informed about the independence of the researcher from their employer, and guaranteed that what they say is not going to be used against them. They were also informed of the possibility that short and anonymized excerpts could be used as examples in this thesis.

## Results

### *Descriptive statistics*

The transcripts (N=15) were unitized into 1408 statements ( $M = 90.9$ ,  $SD = 40.2$ ). Of these, 45 were excluded from the analysis as they were *clearly* irrelevant to the topic of railway safety. Ten statements from two informants were excluded because they

misunderstood the question. The other irrelevant statements were about sports tournaments and retirement plans. The remaining 1363 statements were coded in SCM and SCATC.

The SCM accounted for 868 statements or 63.7% of the statements. These statements distributed across all categories, and the distribution can be seen in Table 1. Interrater reliability was calculated for 157 statements from three interviews, and a Cohen’s kappa of 0.525 was achieved, which is a fair agreement (Watkins & Pacheco, 2000). The agreement about residuals was much higher. Both raters agreed that the number of residuals was 50. Although there was some disagreement about which statements were to be coded as residual, the important issue is that they agreed on the number.

Table 1

*Frequency Distribution of SCM Statements Across Categories*

Category	Count	<i>M</i>	<i>SD</i>
Management	21	1.40	2.20
Safety systems	128	8.53	7.62
Risk	199	13.27	11.52
Work pressure	113	7.53	5.13
Competence / training	195	13.00	8.65
Procedures / rules	140	9.33	5.26
Blame	28	1.87	2.36
Organizational learning	44	2.93	4.98
Residual	495	33.00	20.13
Total	1363	90.87	40.19

The SCATC accounted for 942 statements or 69.1% of the statements. These statements distributed across all categories, and the distribution can be seen in Table 2. Interrater reliability was not assessed for SCATC.

Table 2

*Frequency Distribution of SCATC Statements Across Categories*

Category	Count	<i>M</i>	<i>SD</i>
Work situation	339	22.60	10.91
Flexibility	26	1.73	2.49
Communication	44	2.93	3.53
Report	11	0.73	1.39
Just culture	39	2.60	2.82
Learning culture	82	5.47	5.71
Safety-related behaviours	131	8.73	4.65
Attitudes towards safety	132	8.80	5.72
Risk perception	138	9.20	9.24
Residual	421	28.07	16.77
Total	1363	90.87	40.19

The combined model accounted for 1157 statements or 84.9% of the statements. The number of shared and unique contributions has been illustrated in Figure 1.

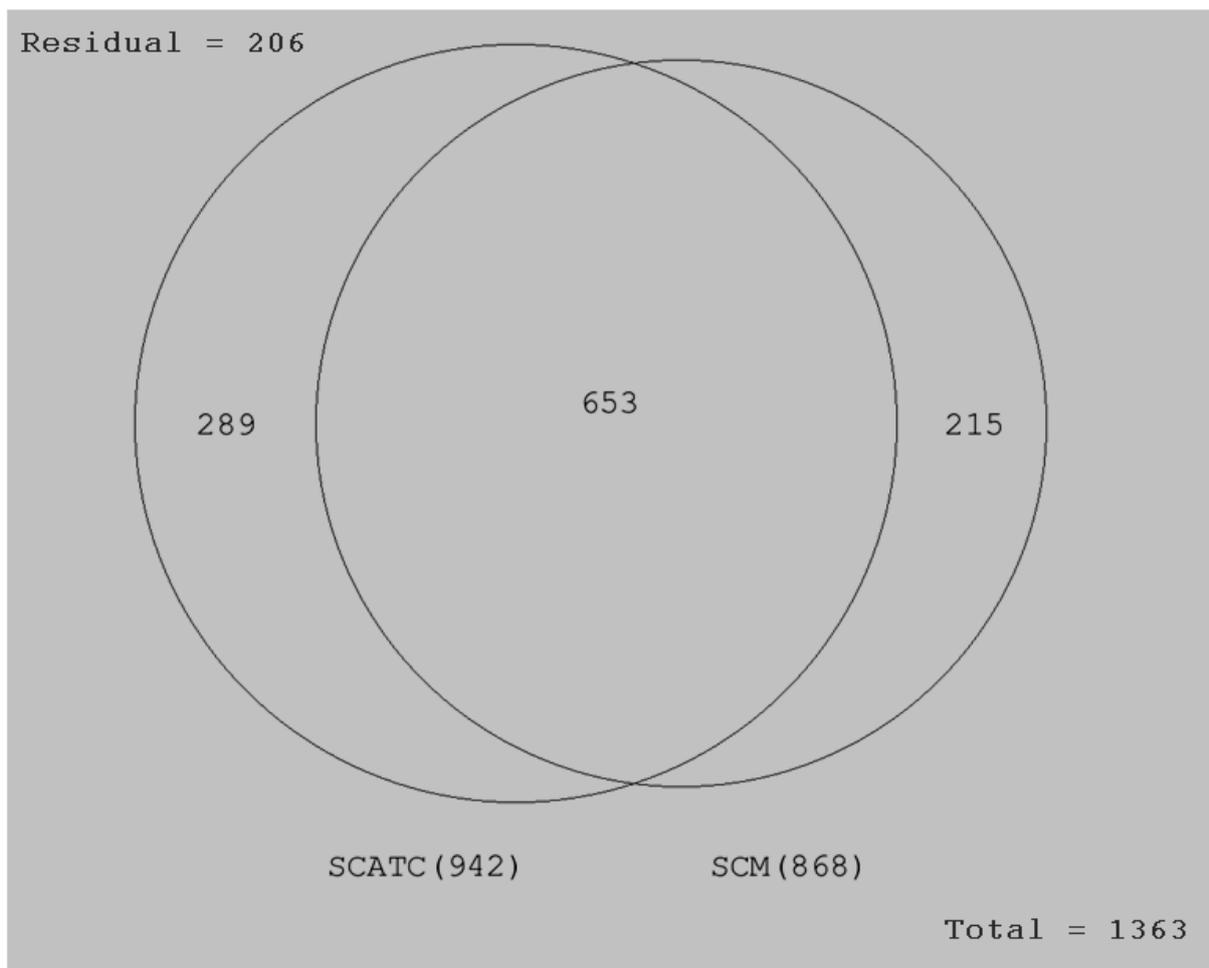


Figure 1. The amount of overlapping between SCM and SCATC. SCM = 868 (M = 57.87, SD = 26.56), SCATC = 942 (M = 62.80, SD = 26.32), Combined model = 1157 (M = 77.13, SD = 33.06), Shared contribution = 653 (M = 43.53, SD = 19.25). Unique contribution of SCM = 215 (M = 14.33, SD = 9.51), Unique contribution of SCATC = 289 (M = 19.27, SD = 13.17).

### *Interjudge reliability on unitizing*

Statements, or coding units, are the building blocks of coding. Interjudge reliability on unitizing was carried out to test the assumption that the definition of a statement is enough to ensure that the statements are comparable in terms of granularity, i.e. level of detail. A graduate student received training and unitized four transcripts independently. Reliability was assessed using a variation of percentage of agreement on presence (P.A.P.; for a thorough explanation of calculations, see Appendix C).

In order to improve the unitizing reliability, the definition of a statement was adjusted two times (see Table 3). The original definition yielded an agreement of 63.6 %. A review of the differences showed that 50% of the statements were extracted exactly the same way, but

for the rest judge A consistently saw more statements than judge B in the same places. Since the problem was systematic, a modification was made by downplaying *smallest* and adding *meaningful* to the definition, and a new training session was held. The P.A.P. increased to 68.9%. However, the systematic differences between the judges changed to the opposite, with judge A consistently extracting fewer and longer statements. A final attempt was made to improve the interjudge reliability, but the P.A.P. stabilized at 57.5% for the last two transcripts. Although this percentage is not optimal, there is no standard against which to compare it. The issue of unitizing reliability has been dealt with in Limitations of this study. The *intrajudge* reliability, while not assessed quantitatively, is considered acceptable based on the fact that the differences between the judges were consistent.

Table 3

<i>Interjudge reliability of different definitions</i>		
Version	Definition of statement	P.A.P.
1	A statement is defined as the smallest codable unit. A unit is codable when it comprises a distinguishable point, or a whole, separable theme. If the theme is repeated immediately it is considered part of the previous theme.	63.6 %
2	A statement is defined as the (smallest) <i>meaningful</i> unit that expresses a whole, separable theme or distinguishable point. If the theme is repeated immediately it is considered part of the previous theme.	68.9 %
3	A statement is defined as the smallest meaningful unit that expresses a coherent, separable point of view. A statement must be small enough to contain only one theme, yet large enough to be meaningful. A shift in positive/negative or temporal focus is indicative of a new statement. A statement can be part of a sentence, a whole sentence or several sentences.	57.5 %

### *Hypothesis testing (inferential statistics)*

Hypothesis 1 predicted that the SCM would account for all safety-related statements. A paired-samples t-test was conducted and showed a significant difference between the number of SCM statements ( $M = 57.87$ ,  $SD = 26.56$ ) and the total number of statements ( $M = 90.87$ ,  $SD = 40.19$ ),  $t(14) = -6.35$ ,  $p < 0.0005$  ( $M = -33.00$ ,  $SD = 20.13$ ).

Hypothesis 2 predicted that the SCATC would account for all safety-related statements. A paired-samples t-test was conducted and showed a significant difference

between the number of SCATC statements ( $M = 62.80$ ,  $SD = 26.32$ ) and the total number of statements ( $M = 90.87$ ,  $SD = 40.19$ ),  $t(14) = -6.48$ ,  $p < 0.0005$  ( $M = -28.07$ ,  $SD = 16.77$ ).

Hypothesis 3 predicted that a combination of the SCM and SCATC would account for all safety-related statements. A paired-samples t-test was conducted and showed a significant difference between the number of statements covered by either model ( $M = 77.13$ ,  $SD = 33.06$ ) and the total number of statements ( $M = 90.87$ ,  $SD = 40.19$ ),  $t(14) = -5.752$ ,  $p < 0.0005$  ( $M = -13.73$ ,  $SD = 9.25$ ).

### *Thematic analysis*

The thematic analysis of the 206 residual statements from the combined model yielded eight themes, displayed in Table 4. The statements have been organized thematically in Appendix E. Below is a short summary of the contents of each theme.

*Account.* This theme contains accounts of past events and incidents. The statements are about an informant's role in the Sjursøya accident as well as an event that changed another informant's view on colleagues in a different work group.

*Colloquial.* Statements that belong to this theme are colloquial or rhetorical in nature. They are comments on safety, but do not describe any specific aspects of safety. Variations of "I don't know" (20), "I can't see any problems" (15) and generally positive comments about safety (13). Some of the statements are meta-comments to the interview situation.

*Development.* Statements in this theme were about the opportunity for various kinds of development. This includes money and capacity limits, and organizational change. This theme contains statements about attempts to privatize traffic control, motivations for change, as well as how economy and public tender regulations hinder development.

*Infrastructure.* This theme is about railway infrastructure and technology, and contains statements about how the future of rail technology will be, as well as comments on the challenge posed by an inadequate infrastructure in the Oslo area.

*Local.* This theme concerns know-how related to local conditions. Statements in Local concern how the effect of delays is different depending on where the delay is, and how they use automatic systems differently from rail traffic control centres in other areas. There are also statements about challenges with small versus large control centres, as well as heuristics for navigation.

*Miscellaneous.* This is a collection of codes that did not fit together with other codes. They are not internally consistent, but statements in this theme cover issues such as motivation for safety, information to passengers, usability and the future.

*Traffic.* Statements in this theme are about efficient traffic control and challenges regarding production. The typical statement in this theme is a comment on capacity overload in the railway or high production. Many statements cover how for instance weather and bad timetables, etc. can lead to delays.

*Work.* Statements belonging to this theme are descriptions of the informants' work environment (both physical and psychosocial) and the nature of their job, for instance compared to other RTCs or air traffic controllers. This theme also covers statements about the tools that they use, as well as comments on how they behave in challenging situations.

Table 4

<i>Frequency distribution of residual statements</i>		
Theme	No. of statements	Perc. of residual
Account	5	2.4
Colloquial	90	43.7
Development	8	3.9
Infrastructure	6	2.9
Local	13	6.3
Miscellaneous	8	3.9
Traffic	40	19.4
Work	36	17.5
Total	206	100

## Discussion

The purpose of this study was to provide an empirical test determining whether SCM, SCATC or a combination of the two can be used as a framework to describe safety climate in the rail traffic management domain. Fifteen interviews of RTCs were transcribed, unitized and coded in the categories of the two models to see how many statements fit into each model. While the applicability of the models as a whole has been investigated in terms of number of statements, the relevance of the categories and themes have been studied mainly in terms of whether they are present or not in the data set.

### *Summary of results*

From the total number of 1363 coded statements, SCM accounted for 868 statements, SCATC accounted for 942 statements, and combined they accounted for 1157 statements. The

statistical analyses indicate that none of the models were able to account for safety climate among RTCs. The thematic analysis of the 206 residual statements identified 8 themes.

*Hypothesis 1* was designed to test whether SCM could be applied directly to the rail traffic management domain. It predicted that SCM would account for all statements. SCM accounted for 868 statements, or 63.7% of the total number of statements. As can be seen from Table 1, statements were distributed across all categories. The results from the statistical test did not support the hypothesis, suggesting that SCM failed to account for all statements.

*Hypothesis 2* was designed to test whether SCATC could be applied directly to the rail traffic management domain. It predicted that SCATC would account for all statements. SCATC accounted for 942 statements, or 69.1% of the total number of statements. As can be seen from Table 2, statements were distributed across all categories. The results from the statistical test did not support the hypothesis, suggesting that SCATC failed to account for all statements.

*Hypothesis 3* was designed to test whether SCM and SCATC supplement each other so well that their combined thematic structure can be applied directly to the rail traffic management domain. The combined model accounted for 1157 statements, or 84.9% of the total number of statements. The results from the statistical test did not support the hypothesis, suggesting that even the combined model lacks categories to describe all statements.

*Hypothesis 4* was designed to investigate whether the residual statements from the combined model had relevance for safety climate in rail traffic management. The hypothesis predicted that these statements had no relevance for safety climate. The thematic analysis identified 95 statements, or 46.1% of the total number of residual statements, as irrelevant for safety climate. Only 35 statements, or 17.0% of the residual, constituted completely new themes. The rest were themes that had some resemblance to themes in the tested models. The hypothesis was partially supported, suggesting that the results from the three previous hypotheses should be moderated.

#### *Relevance of the model categories*

While the applicability of the safety climate models as a whole was investigated in terms of the number of statements they accounted for, the relevance of the categories was assessed mainly in terms of whether they were present in the data set or not. It has been demonstrated that all categories accounted for some statements. This means that all categories are present in the data set. If a category describes a part of the data set, this can be taken as evidence of that category's relevance to safety climate in rail traffic management. However, a

comparison of the relevance of categories has not been made, because relevance cannot be quantified with the methods of this study. If a category has few or no statements, the only thing that is certain is that the informants did not speak (much) about it at the time of the interviews. For instance, in this study there were only 28 statements about blame. This could either be because blame has nothing to do with safety climate, or because blame is not a major issue in the control centres where the interviews were carried out. However, there is no way of knowing, because the next informant that is interviewed may possibly describe how fear of retribution has deterred workers from giving critical information to the management about safety system performance. Hence, one cannot determine the relative relevance of a set of categories with the methods used in this study.

Since presence of a category means that it is relevant, it is interesting to look for themes present in the part of the data set that was not covered by the models. In line with the argumentation above, the themes that the thematic analysis identifies should in principle be relevant for safety climate.

#### *Relevance of the residual*

In determining whether the statements from the thematic analysis were relevant to safety climate it can be useful to divide them in three types of relevance: those that were irrelevant to safety, those that were relevant to safety and could have been coded in the existing models with a lenient coding regime, and those that constituted new themes that were relevant to safety.

The first type, irrelevant statements, consisted of the themes Account and Colloquial, and accounted for 46.1% of the statements in the thematic analysis. With its 90 statements, Colloquial was the largest theme in this analysis. It consists of utterances that help the conversation flow. Although these utterances are not directly irrelevant to the topic of safety, they do not add much meaning to the conversation. This conversational "glue" is necessary in order to talk freely, and is a by-product of the interview method used. The five statements in the theme Account were also considered irrelevant to safety climate. These statements were meaningful, but they were accounts of past events and could not be associated with safety climate. Therefore, the conclusion for this part of the residual is that these two themes have no relevance to safety.

The second type was statements that were relevant to safety and could have been coded in SCM or SCATC. However, due to the fact that definitions of the categories were strictly based on the definitions found in the original literature, these statements could not be

coded within the models. Of the total of 206 residual statements, 76 statements or 36.9% can be said to belong to this type. These statements belong to the themes Traffic and Work. Traffic, for instance, has certain similarities with Work pressure in SCM. Many of the statements in Traffic were explanations of how traffic is managed during high workload and challenges around the intensity of production, which is what Work pressure covers. Additionally, Work was quite similar to the theme Work situation in SCATC. Both Work and Work situation cover aspects of the work environment, professional relationship between the RTCs, and the nature of the traffic control work. Both themes in this group of relevance had similarities with categories in SCM and SCATC. Therefore the statements are relevant to safety climate, but they do not add any new category to the safety climate framework. This suggests that although SCM, SCATC and the combined model do not account for all statements, some of the unaccounted for statements may still fit into the model with minor adjustments to the definitions of the categories.

The third type was statements that were relevant to safety and that could not have been coded in the existing models even with a lenient definition. There were 35 statements of this type, constituting 17.0% of the residual, and they were spread out on the themes Development, Infrastructure, Local, and Miscellaneous.

Infrastructure and Local appear to be domain-specific themes with high relevance for safety climate. The statements in these themes describe some of the challenges and requirements specific to rail traffic management. Infrastructure is a description of the quality of the railroad, which has a large impact on the daily work of RTCs. Had a thematic analysis been conducted on the entire data set, the theme Infrastructure would probably have been much larger. For instance, the state of technical equipment was captured by Work situation in SCATC, although conceptually it is closer to Infrastructure. The theme Local contains explanations on how local differences affect the balance between safety and efficient production. According to these statements, knowledge of local conditions is necessary in order to do a satisfactory job. Therefore, perceptions of local conditions may be very relevant to safety climate.

Development and Miscellaneous also contain statements that are relevant to safety climate but cannot be coded in SCM or SCATC. Although some of the statements in these themes are relevant for safety climate, it is hard to argue that the themes themselves are relevant. The statements in Miscellaneous are few and very different from each other, so including it as a theme in a theoretical safety climate framework will not make the framework better. The statements in *Development*, however, are more coherent. These are about

opportunities for development. This is relevant for safety climate in the sense that the *raison d'être* of RTCs is to maintain safety, and any development can be seen as an attempt to improve safety. For instance, one informant has described how privatization of rail traffic management is a threat to safety (Appendix E, no. 99-100). Based on the small number of statements in Development and Miscellaneous it is difficult to conclude with certainty that these themes are crucial for safety climate. However, since some of the statements appear to be relevant, these themes have been included here so that this particular issue can be solved by future research.

In conclusion, the thematic analysis indicates that of the 206 statements, at least 83.0% did not add anything new to the thematic structure of SCM and SCATC. In brief, two themes with a total of 95 statements (46.1% of the residual) were irrelevant for safety climate. Two themes with a total of 76 statements (36.9%) were similar to the models' themes. This left 35 statements (17.0%) divided on four themes that did not exist in the models. These themes were Development, Infrastructure, Local, and Miscellaneous. Together, they constitute 2.6% of the total number of statements in this study. If this had been considered in the inferential statistics, the statistics may very well have indicated that SCM or SCATC were able to cover all statements. In light of these numbers, the implications from the results of Hypotheses 1-3 must be moderated in favour of the models.

### *General discussion*

None of the models were able to account for all statements. It appears that safety climate in the rail traffic management domain is different from the industries that SCM and SCATC have been based on. This contradicts the principle behind generic models, namely that the thematic structure of safety climate is the same across industries. This is partly supported in Figure 1, which shows that SCATC covers 289 of the 495 statements that fall outside the SCM. This suggests that many of the statements that cannot be covered by generic categories are covered by domain-specific categories. Similarly, SCM covers 215 of the 421 statements that fall outside SCATC. This could mean that SCM is able to capture generic categories that SCATC overlooks. At the same time, 206 statements fall outside both models. Hence, the most straightforward explanation for why the models fail to account for all statements is that safety climate in rail traffic management is so domain-specific that to some extent it differs even from safety climate in air traffic management.

Another explanation is that the models themselves are weak. Had the SCM and SCATC been tested with this approach within the industries that they had been developed on

it is possible that it would result in an equally bad fit. In that case, the reason why the models fail to account for safety climate in rail traffic management would not be because of industrial variations in the factor structure, but because of the models' unsuitability for their original purpose.

This study has demonstrated that safety climate frameworks do not remain valid when they are applied to another industry. This may become a problem for Det Norske Veritas, which intends to document the effect of the JBV's safety management system with a tool that has been developed for another domain (Rolfsen, et al., 2010). If a model is used that does not capture all aspects of safety it is difficult to know whether all relevant effects of a safety improvement measure have been documented. Negative effects may slip by unnoticed, and the organization can drift towards failure.

#### *Limitations of this study*

The *sampling* for this study was not done randomly. For practical reasons the selection of participants had to be done by a contact person in each rail traffic control centre. Therefore there is a possibility that people may have been selected in a biased way. A selection bias may attract participants who favour certain conversation topics over others, giving a possibly skewed distribution of statements in the model or across categories. Had the participants been randomly selected, one could have assumed that these preferences for conversation topics would cancel each other out. Random sampling was not possible in this study. Therefore it is difficult to know how representative the fit between the models and the data are without a replication on a different sample of RTCs.

The purpose of this study was to investigate whether the models are able to account for the safety climate among RTCs. What has been tested is whether there is a gap between the models and the data, and such a gap has been demonstrated. If a replication of this study is carried out on a different sample of RTCs and it shows that the models fit the new data better, there will still be a gap between the models and the safety climate among the RTCs who participated in the present study. Therefore, a non-random sample does not invalidate the conclusion that the models do not account for safety climate in rail traffic management. However, if the RTCs in this study have been exceptionally well-aligned with the safety climate models, this study may have fallen short of demonstrating an even worse fit between the models and the rail traffic management domain.

Several informants felt that the *interview questions* were difficult to understand. The questions ask specifically about safety climate, but this is not a word in common usage, and

several informants asked for clarification. At the beginning of each interview the concept of safety climate was explained briefly in a standardized manner without mentioning the specific categories in the models. This was done to inform the participants about the purpose of the study, but it also served as an explanation. There is a possibility that the informants did not quite understand what they really were answering, and this may have increased the number of general or irrelevant statements. In turn, this may have contributed to the statistically significant gap between the models and the data.

A weakness with many studies that use coding is that they do not account sufficiently for the process of *unitizing*. Often the underlying assumption is that a good definition of a statement is enough to achieve high unitizing reliability. However, this assumption is hardly ever tested empirically. Murphy and Ciszewska-Carr have demonstrated that unitizing based on segments of meaning is less reliable than unitizing based on more objective measures such as sentences or paragraphs. (Murphy & Ciszewska-Carr, 2005, Table 3). Since the transcripts in this study have been unitized based on meaning, there was a good reason to assess the interjudge reliability of unitizing. Attempts were made to improve the unitizing reliability, with little success. As can be seen from Table 1, unitizing based on the third definition had a lower reliability than that based on the second definition. However, as the definitions themselves vary very little, this variation may have been due to differences between transcripts in how difficult they were to unitize. If this has been the case, further attempts to improve reliability would not necessarily have yielded noticeable results. Besides, by the time the results from the third version were ready a majority of the transcripts had been unitized. Unfortunately there was no time to prioritize a new unitizing. Because statements are the most basic building block of the analysis this may have had implications for the coding. One would not know how much of the fit between the models and the data could be attributed to the way the transcripts had been unitized. This poses a challenge to the replication of this study, and has been addressed in the Future studies section.

*Coding* is also a subjective process, but as opposed to unitizing it has traditionally received much more attention with respect to reliability. In order to reduce the effect of personal interpretation of statements on the coding, a rigorous coding regime was followed. The operational definitions of the categories were based only on definitions found in research papers, and if a statement did not fit perfectly in any category, it was coded as a residual. Still, the coefficient of agreement on an excerpt of the data set was 0.567, which is only a fair agreement (Watkins & Pacheco, 2000). The reason behind this could be that the operational definitions were unclear, that the other rater used SCM in a slightly different way in his own

study, or simply that he judged the statements differently. Regardless of the reason for the differences in coding, a systematic disagreement would only have affected the conclusions of this study if there had also been a disagreement regarding the size of the models' residual. This was not the case, as both raters coded 50 statements as residual. Because the applicability of the models has been tested in terms of the number of statements they account for, there is no indication that the fair interrater reliability has weakened the conclusions of this study. However, if this study had considered the relative importance of the categories, this interrater reliability would have been an issue of concern.

The applicability of the models to rail traffic management may have been wrongly reduced by the *rigorous coding regime*. This is partly supported by the results from the thematic analysis, which indicated that two of the themes, Traffic and Work, are very similar to the categories Work pressure (SCM) and Work situation (SCATC). These themes could easily have been included in the existing categories if the definitions of the categories had been less strict. Therefore it is possible that a more lenient coding regime would have improved the models' ability to account for safety climate in rail traffic management.

A vulnerability of thematic analysis is that it is difficult to replicate. One aspect of this problem is that there is no one way of doing a thematic analysis (Braun & Clarke, 2006). To counter this effect, the procedure of Braun and Clarke (2006) was followed thoroughly. Another aspect is that thematic analysis is a subjective analysis, so one may question whether a conclusion based on thematic analysis is really valid. Due to practical reasons, no reliability testing was conducted. However, the statements that were subjected to thematic analysis are provided in Appendix E, and the procedure for the analysis has been made transparent. Therefore, it is possible to evaluate how the results were achieved, which is the next best solution after demonstrating high reliability.

### *Future studies*

In this study, the relevance of a category for safety climate has been described in terms of how many statements the models have accounted for. Only the residual was subjected to a bottom-up identification of themes. Therefore, this study may have overlooked a more pervasive thematic pattern in the entire data set. While the approach used in this study focused on the applicability of the models, a thematic analysis of the entire data set would provide a more independent examination of how safety climate is in the domain of rail traffic management. A thematic analysis of all statements, while being more time-consuming, may

reveal a better factor structure than the mixture of categories and themes resulting from the present study.

A challenge with research that employs thematic analysis on a group of residual statements is that the chance of identifying new themes is high, regardless of whether these themes are relevant to safety climate. However, care should be taken not to add uncritically every theme that appears relevant at first glance. In order to evaluate the findings of this study, future studies should assess the relevance of the themes identified in the thematic analysis together with the categories from SCM and SCATC. One way this can be done is to ask RTCs or other workers with good domain knowledge to rate the importance of the themes and categories for safety. The strength of this approach will be that the relative prioritization of the themes and categories will be done consciously by the participants. As an added benefit, this would provide empirical evidence for or against the assumption that mentioning something means that it is relevant, which has been implicit in this study. An alternative approach could be to ask RTCs to rate a list of survey items based on these themes and categories. Survey items are more specific than themes and categories, and they are therefore less vulnerable to personal interpretations about how they are intended to be relevant to the domain of rail traffic management.

As previously mentioned, one of the weaknesses in the methodology of this research was unitizing reliability. A way to circumvent this problem is to define statements in terms of more objective units such as sentences. As one sentence may contain several topics, the restriction of each statement being coded only once would have to be removed, so that each sentence could be coded in several categories in each model. By using the same data set and changing only the unitizing, and keeping the rest of the methodology similar to this study, one would get an indication of whether the findings in this study can be attributed to real differences or to the methodology. Such a manipulation of the methodology would also provide useful, empirically based advice regarding the implications of the choice of unitizing type for this kind of climate model validation.

## Conclusion

This study has investigated whether two models for safety climate are able to account for safety climate among RTCs, both separately and in combination. Although the models were able to account for approximately 60 – 85% of the statements and that the categories appear relevant to safety climate in the rail traffic management domain, the results indicate

that the residual is of a significant size. The implication of this finding is that if these models are applied directly to this domain, they will provide an incomplete picture of the safety climate. This is the case regardless of whether one applies a generic framework, a domain-specific framework, or a combination. The finding that the models do not account sufficiently for safety climate is further supported by the thematic analysis, which identified four new themes (Development, Infrastructure, Local and Miscellaneous) that appear to be relevant for safety climate. However, the thematic analysis also suggests that the safety climate models are more relevant than they appear to be from the statistical analyses, because the new themes represent only 17.0% of the residual (2.6% of total statements). Hence, the models are not irrelevant for safety climate in rail traffic management but they are insufficient. Relying entirely on an incomplete model will allow that changes in safety climate slip by unnoticed, allowing the organization to drift into failure. In light of these results, if the JBV intends to document improvements in safety climate, it should make certain that the models that are being used have been validated for use in the railway industry.

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## Appendix A

### Coding Manual

In the following coding manuals the operational definitions of categories in SCATC and SCM are based only on how they have been defined in previous studies. Since this study is a test of these models, these codes should be strictly adhered to, and if a statement does not fit any category in a model it is to be coded as a residual (0).

#### *SCM*

Adapted from Flin et al. (2000).

#### **1. Management**

Perceptions of management's commitment, attitudes or behaviours in relation to safety, production or other issues (such as selection, discipline, planning, etc. satisfaction with supervision).

#### **2. Safety systems**

A very broad theme comprising aspects of the organization's safety management system. State or performance of safety officials and committees, permit to work systems, safety policies, safety equipment, safe job analyses.

#### **3. Risk perception**

Self-reported risk taking (does not need to be violation of rules), perceptions of risks or hazards, attitudes towards risk & safety.

#### **4. Work pressure**

Work pace and work load. Challenges regarding balance between safety and production. Do not include other things that *could* fit, e.g. temperature, fighting, noise.

#### **5. Competence, training**

Colleagues' or own level of qualifications, skills and knowledge. Selection, training, competence standards, assessment of competence. Competence in non-technical skills (e.g. leadership, decision-making).

## **6. Procedures, rules**

Perception or opinion of safety rules, attitudes to rules, compliance with or violation of procedures, but not general descriptions of procedures.

## **7. Blame**

No explanation by Flin et al. Imset (2008) provides a short definition: “Perceptions of how blame is distributed in the wake of accidents or incidents”. In practice, code exactly as Just culture in SCATC.

## **8. Organizational learning**

No explanation by Flin et al. Statements that fall into this category should be about how the organization learns from experience.

### *SCATC*

Adapted from (Ek, 2006, pp. 26-28; Ek, et al., 2007, pp. 793-794; Ek, Akselsson, Arvidsson, Johansson, & Josefsson, 2003, p. 3).

### **1. Working situation**

The individual’s perceived *Working situation* involves items such as cooperation, support, appreciation of work, mental and physical fatigue, adequate education and training in work practices, staff sizes, liking their job and their colleagues, and having an influence in the design of work. The category contains issues that can affect the employees’ work performance as well as the possibility to live up to established safety rules and demands. Also includes access to and condition of equipment, and the training to use it in a safe way.

### **2. Flexibility in the organization (organizational)**

Concerns utilizing staff resources efficiently, the ability to take over another person’s tasks, and the ability to transform the work organization in order to stand prepared for changing demands, e.g. periods of high workload. It also comprises appreciation and respect for the skills, knowledge, experiences and abilities among operators and supervisors. Also includes statements about whether there is encouragement or acceptance to suggest improvements or point out flaws.

### **3. Communication in the normal work**

Concerns need for and clarity of information, and receiving information in time to do a safe job. Information exchange on handover. Communication between people and between work groups, training for communication during accidents, and clarity about whom to contact concerning safety issues.

### **4. Reporting culture (organizational)**

Reporting incidents and anomalies. Expressing opinion about safety. Reaction towards reports. Management listens to safety worries. Reporting system. Receiving relevant safety information. Information about incidents or near-misses. If the statement focuses on *reporting* irregularities to higher organizational levels or to incident databases it should be coded as *Reporting*. If it focuses on the activity of using reports for improving safety it should be coded as *Learning*.

### **5. Just culture**

Fairness of judgement. Blame and scapegoating. Anxiety for punishment. Clarifying the distinction between acceptable and unacceptable behaviour, acknowledgement for safe work. Making colleagues aware of safe or unsafe performance or receiving such notification.

### **6. Learning culture**

Concerns collecting, monitoring, and analyzing information and experience in order to improve safety. Implementing changes within reasonable time, and proactive vs. reactive approach. [Formally] sharing experiences with others. Taking problems seriously. Willingness to introduce and follow up changes. Up-to-date knowledge about work and safety, and how this information is followed up.

### **7. Safety-related behaviours**

*Safety-related behaviours* constitute both individual and organizational behaviours in relation to safety. The aspect includes items such as: Existence of [informal] safety discussions, compliance with safety procedures, functionality of rules and routines, risk taking or working in a safe manner, encouragement to work safely and being orderly, pressure to take shortcuts, and having received sufficient training for emergency situations.

### **8. Attitudes towards safety**

*Attitudes towards safety* constitute individual and organizational attitudes concerning the importance of safety. Examples are: belief that top and middle management or operators are committed to and work for good safety; managements' interest in the wellbeing of operators; encouragement of safe practices; appreciation of safe work; belief in the usefulness of safety exercises; personal responsibility for safety; whether education and training are deemed important by management; and employee participation in planning for safety.

## **9. Risk perception**

*Risk perception* contains items concerning the belief that the work is carried out safely; the size of risk for the individual getting injured on the job or that one's work could lead to others being injured; the experience of having influence on safety at work; trust for middle management concerning safety at work; and the belief that work is carried out with good safety margins.

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## Appendix B

### Interview Guide

- Hatt en hektisk/rolig dag?
- Har du fått lest informasjonsskrivet?

#### **Info om rettigheter**

- Deltakelse er frivillig
- Kan trekke deg når du vil uten å oppgi noen grunn
- Kommer ikke til å bli brukt til å sammenligne TSS eller personer. Anonymt.
- Snakke tydelig – iblant kan det være vanskelig å forstå ting på lydbånd

#### **Premisser for intervjuet**

- Jeg kommer ikke til å si så mye – det er dine tanker som togleder/trafikkstyrer som er interessante. Men hvis du ikke forstår spørsmålet eller noe er det bare å spørre.
- Jeg kommer til å spørre deg om sikkerhetsklima. Du har kanskje en formening om hva sikkerhetsklima er?

Jeg vil høre hva du tenker om sikkerhetsstatusen på denne trafikkstyringssentralen pr. i dag.

#### **Hovedspørsmål**

- 1) Hva mener du er styrkene med dagens sikkerhetsklima i denne trafikkstyringssentralen?
- 2) Hva mener du er svakheter med dagens sikkerhetsklima i denne trafikkstyringssentralen?

Hvis vi nå tar utgangspunkt i dagens nivå av sikkerhet på denne trafikkstyringssentralen:

- 3) Hva kan på sikt være en utfordring for sikkerheten? (T)
- 4) Hvilke muligheter har man til å **utvikle** sikkerhetsklimaet? (O)
  - a. Du nevnte en del svakheter – hvordan kan man forbedre sikkerhetsklimaet?

#### **Mulige oppfølgingsspørsmål**

- Kan du utdype det?
- Hva mener du?
- Hva da?

- Har du et eksempel på det?
- Du har allerede nevnt noen styrker/svakheter/positive/negative sider ved sikkerheten.  
Hvilke andre S/W/O/T gjelder her?

### **Demografi**

Alder:

Fartstid i jobben:

Erfaring generelt:

Kjønn: M K

### **Debrief**

- Resultatet klart i mai 2011
- Noe du lurer på?
- Føler du at jeg har behandlet deg bra?
- Takk

## Appendix C

### Calculation of Percentage of Agreement on Presence

This appendix explains how to calculate interjudge reliability of statement extraction. For this calculation a formula for interrater reliability in coding has been adapted from Boyatzis (1998). The percentage of agreement on presence (P.A.P.) is originally a measure of agreement between coders about whether a certain behaviour has occurred or not. Similar with specific behaviours, a statement is either present or it is not. The original formula is (Boyatzis, 1998, p. 155):

$$P.A.P. = \frac{2 \times (\text{no. times both Coder A and Coder B saw it present})}{(\text{no. times Coder A saw it present} + \text{no. times Coder B saw it present})}$$

The adapted parameters are:

$$P.A.P. = \frac{2 \times (\text{no. S agreed})}{(\text{no. S extracted by Judge A} + \text{no. S extracted by Judge B})}$$

Interjudge agreement on a statement is defined as when both extractions have the same starting and ending point (100 % agreement). Partial agreement is also possible when one judge sees two or three statements where the other sees one (50 % and 33 % respectively). The number of agreements (complete and partial) are added up and weighed. When the difference is **four-to-one** I arbitrarily decided that this is no agreement.

Example:

Judge A extracts 150 statements

Judge B extracts 140 statements

They agree 100% on 100 statements

They agree 50% on 20 statements

They agree 33% on 15 statements

$$P.A.P. = \frac{2 \times (100 + (20 \times 0.5) + (15 \times \frac{1}{3}))}{(150 + 140)} = \frac{2 \times (115)}{290} = 79.3$$

Other alternatives

Percentage of agreement is

$$P.A. = \frac{\textit{Agreements}}{\textit{Agreements+disagreements}} \text{ (Watkins \& Pacheco, 2000)}$$

$$P.A. = \frac{\textit{Coding agreed}}{\textit{Coding possible}} \text{ (Boyatzis, 1998)}$$

Both of these variations assume a limited number of coding units to rate. The problem with statement extraction, which contributes to lower reliability, is that there is no right answer to the number of total statements, unless you average the judges total numbers (which you do with P.A.P.).

Cohen's K is another alternative, but the only difference between Cohen's K and P.A. is that the former considers chance agreement. However, there is little sense in calculating chance agreement when you have to guess how much the definition has influenced the process.

## Appendix D

### Informasjonsskriv til deltakere

Takk for at du har vist interesse for å delta i dette forskningsprosjektet. Formålet med prosjektet er å teste vitenskapelige modeller av sikkerhetsklima. Intervjuet du nå skal delta i bidrar til en bedre forståelse av hvorvidt disse generelle modellene stemmer med arbeidssforholdene i en trafikkstyringssentral.

#### **Hvordan kan du forberede deg?**

Intervjuet kommer til å dreie seg om sikkerhetsklimaet på trafikkstyringssentralen din. Sikkerhetsklima er folks tanker og holdninger til det nåværende sikkerhetsnivået på en arbeidsplass. Det er *dine* personlige meninger og erfaringer som er interessante i dette intervjuet, ikke hva andre tenker. I tiden fram til intervjuet ber vi deg tenke litt over hvordan sikkerhetsklimaet er på arbeidsplassen din.

#### **Deltakelse**

Erfaringsmessig tar slike intervjuer ca. 30 min. I henhold til etiske retningslinjer for forskning er det frivillig å delta, og du kan når som helst trekke deg fra intervjuet uten å oppgi noen grunn.

#### **Håndtering av datamaterialet**

Etterarbeidet med et intervju er ganske tidkrevende, og det gjøres mange intervjuer. For å lette dette arbeidet tas alle intervjuer opp på bånd. Det vil sikre en korrekt gjengivelse av det du sier. Lydfilene brukes til å transkribere intervjuet, og slettes senest ved prosjektets slutt i mai 2011. Transkripsjonene beholdes i anonymisert form for bruk til fremtidig forskning.

#### **Konfidensialitet**

Alle opplysninger og hele datamaterialet behandles konfidensielt. Kun undertegnede og et begrenset antall medhjelpere vil ha tilgang til lydfilene, og da kun for transkribering eller kvalitetssikring av transkribering. Sitater kan brukes i den ferdige oppgaven, dog i anonymisert form. Det vil ikke være mulig å knytte sitater til enkeltindivider.



Undertegnede er masterstudent ved Universitetet i Oslo og har ingen tilknytning til Jernbaneverket utover at sistnevnte bidrar med praktisk tilrettelegging av intervjuene. Det vil ikke bli gjort noen vurderinger av individuelle eller organisatoriske prestasjoner. Faglig veileder er dr. Cato A. Bjørkli ved Psykologisk institutt, Universitetet i Oslo. Ved spørsmål, kan undertegnede kontaktes på 97062004 eller [sasanz@student.uio.no](mailto:sasanz@student.uio.no).

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Dato

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Signatur (Sasan Zarghooni)

*Jeg er kjent med denne orienteringen og gir mitt samtykke til å bli intervjuet.*

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Dato

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Signatur (informant)



## Appendix E

### List of Statements from the Residual

#### *Account*

1	Nei altså, det som skjedde på Alnabru, er vel det at, det er jo Jernbaneverket som har fått boten, og CargoNet har jo fått en stor bot ifra Politiet eller ifra påtalemyndighetene.
2	Vi var der nede om natta, og det... Vi tråkket tunnelen opp og ned og så på hva de jobbet og sånt noe, og det gikk sånn på skinner! Og arbeidet skulle være ferdig 5:50, og det vet jeg for jeg hadde laget ruten eller arbeidsinstruksen selv.
3	Og bare det jobben min ble egentlig, da for siden jeg satt på Lillestrøm, og da hadde jeg inn- og utkjøringa fra Alnabru, og jeg hadde Bryn, så for det hører til Lillestrømplassen som det heter.
4	Da vi fikk det så var det bare hvor vi skulle gjøre av vognene.
5	Og den gangen var jeg vel en sint ung mann. I hvert fall yngre enn det jeg er nå. Og litt mere bombastisk. Og hvis du hadde en rekvisisjonsfrist på onsdagen, så du kom på torsdagen, så var det ”NEI!”. Jeg var en sånn (...) jævlig firkantet.

#### *Colloquial*

6	Da vil jeg begynner å henge ut folk, så det veit jeg ikke helt om jeg,
7	. Og med sånt noe, altså hvor 110 prosent sikkert dette skal jo... Altså dette er jo andrehåndsupplysninger som jeg sitter inne med, av mennesker som jeg kjenner der oppe da
8	. Jeg er så dum at jeg aldri har gjort det jeg da, men det er noe helt annet. Jeg har vært togleder siden [årstall], jeg begynner å ha... jeg har noe erfaring som togleder.
9	uten at jeg skal at det er riktig, men det er jo kanskje, det her er jo sterke følelser i sving og da. Så ord kan kanskje bli brukt på en litt gæren måte i sånne situasjoner også,
10	Ellers så er det mulig at jeg er såpass stakk dum at ikke jeg ser eller merker noe sånt noe, men jeg har ikke merket noe negativt her i det hele tatt. Eller oppfattet noe negativt.
11	Men jeg har ikke noe kapasitet nok til å se at det skulle være noe som... Jeg kan ikke skjønne at det skulle være noe som skulle være negativt på dette herre her.
12	Det er godt mulig, men jeg greier ikke se noe akkurat nå. Beklager det.
13	Nei den tror jeg er veldig bra. Det tror jeg.
14	Jeg vet ikke... hva jeg skal si da, jeg.
15	. Syns det fungerer bra, jeg, det som er. Har ikke noe spesielt å komme med der, tror jeg.
16	Nei jeg vet ikke hva det skulle blitt for noe, jeg. Jeg er vel kanskje litt sånn gammeldags tenkende, jeg vet ikke...
17	Det har jo blitt veldig forandring her siden denne sentralen ble åpnet, da. Mot det som var den gamle sentralen.
18	Nei, altså. Det vet jeg ikke for å være helt ærlig. Altså.

19	Altså, jeg må si jeg skjønner ikke helt hva du mener med klima, altså.
20	Det... ikke sånt som jeg kommer på direkte, det syns jeg ikke. Nei.
21	Du har jo sett disse her grafene som har med tider og tog og alt sånn...
22	Tolv på natta, ja, altså det er jo... det går ett døgn per graf.
23	Nei ikke sånn, det er jo liksom sånn jeg ikke kommer på, men sitter og prater sånn nå, så kanskje det dukker opp.
24	Nei, altså, jeg ser ikke sånn store utfordringer som kan bli noe, altså på sikt, noe større, eller problemer eller noen store utfordringer.
25	Det er... utfordringene er jo der i hverdagen, og å takle de.
26	Akkurat videreutvikle det per i dag, vet jeg ikke,
27	Nei. Ikke sånn som jeg kommer på i farten, det syns jeg ikke.
28	Nei. Ikke noe sånn særlig.
29	jeg er jo relativt ny i Jernbaneverket, har jobbet her i [antall] år,
30	Føler vel generelt at det er veldig bra, jeg altså, her. Som sagt, så har jeg ikke jobbet her så lenge, [antall] år, men på de årene jeg har jobbet her så føler jeg at det er veldig bra sikkerhetsklima her, det må jeg si.
31	Så så veldig mye å forbedre, det vet jeg ikke om det er, egentlig. Jeg føler det er veldig høyt nivå på det rett og slett.
32	Ja nå har ikke jeg noe å sammenligne med i og med at det bare har vært her inne da,
33	Igjen så har jeg ikke noe sammenligne med men altså
34	Nei, det veit jeg rett og slett ikke for jeg ser ikke noe sånne direkte svake punkter.
35	Eller så kan jeg ikke tenke meg noe annet.
36	. Men noe mer for form for på en måte da informasjon for å forbedre sikkerheten det er jeg ikke sikker på hvordan man skulle få til engang.
37	Men ellers fra det så er jeg veldig usikker på hva jeg skal trekke fram som negativt da.
38	hvis det er svaret så, så er det klart det er ting som kan påvirke. Kanskje også da i negativ retning, som da en utenforstående ikke vil få med seg når en kommer inn..
39	det blir jo mange punkter for så vidt,
40	Nei jeg veit ikke, jeg har ikke tenkt noe særlig over det.
41	, men klima synes jeg ikke det er noe svakhet med.
42	Det er selvfølgelig mange ting som påvirker sikkerheten.
43	Det burde ikke være nytt det. Er du ikke enig, da?
44	Ja. Det veit jeg ikke.
45	Har ikke noe bedre å tilføye.
46	Jeg klarer ikke å finne noe, tenke på noe nei.
47	Jeg vet ikke. Rett og slett, jeg vet ikke.
48	Nei. Jeg klarer ikke å komme på noe særlig mer fornuftig å si, i hvert fall.
49	Ja, det er jo flere aspekter ved det.

50	Som i baneavdeling, signalavdeling, altså driftsapparatet spesielt, da.
51	”. Så det er nok en iøynefallende trussel.
52	. Det er jo mange fallgruver, det er mye som skal stemme alltid. Det er jo hvert fall det jeg ser på som hovedutfordringene i fremtida.
53	Det er mange muligheter til det, egentlig.
54	Ja, da går vi inn på tekniske ting.
55	Men det er kanskje det jeg mener som kanskje var litt negativt i forhold.
56	Det er jo ganske forandret om du ser rundt her for 15 år siden. Og til det bedre. I forhold til sikkerhetsklimaet.
57	Nei, jeg tror ikke jeg har noe mer å tilføye.
58	Ja. Det er vel stort sett den eneste jeg har nå.
59	Det vet jeg ikke hvem som har vært tilstede på den analysen,
60	Det har sikkert Oslo snakket om.
61	Ja, det er jeg litt usikker på.
62	Ja, sånn at de virker, da.
63	Nei. Vanskelig å si.
64	Spørs jo litt på... veldig på situasjonen, da.
65	Nei, jeg vet ikke.
66	Det gjør det nok.
67	Da kommer du sikkert til å få et svar også fra han fra elkraft.
68	De to punktene der syns jeg ser ut som, her og nå, som de største truslene mot sikkerhetsklima.
69	Ja. Det var vel egentlig det jeg kom på akkurat nå.
70	Men det blir sikkert litt feil å dra det inn i en sånn type undersøkelse.
71	Nei, jeg har vel egentlig ikke noe særlig svar på det.
72	Jeg kan ikke si konkret at jeg har noe forslag til noen endringer. Det har jeg ikke.
73	Og det er på en måte i det øyemed at det er viktig at man hele tiden tar en vurdering, da, underveis.
74	og du må ikke spørre meg om eksempler på det for det klarer jeg ikke å komme med akkurat nå da, i og med at da måtte jeg ha forberedt meg litt bedre
75	Det er på en måte, hvis man kan si at det er en svakhet i sikkerhetsmiljøet, så vil jeg si at det er det. En ytre påvirkning på det.
76	Nei, da er jeg ferdig.
77	Eh, ja, hvilke muligheter er det man ikke har?
78	Nei. Altså, det har jeg ikke. Har ikke tenkt på det.
79	Nei, jeg har ikke tenkt på det. Det...
80	Nei, og det er ikke overraskende, og det er jo veldig bra.
81	Nei, jeg syns egentlig det var bra spørsmål. Jeg har ikke så mye å tilføye. Syns jeg egentlig har sagt ganske mye.
82	Ja, både styrker og svakhet i sikkerhetsklima oppe hos oss, det er litt vanskelig å sette en finger på det,

	men vi føler at det er veldig bra.
83	Nei, det er litt vanskelig å sette finger på, egentlig. For å si det sånn.
84	Nei, jeg tok kanskje litt hardt i isted.
85	Ja, si fra syv til ni timer, avhengig av hva slags type vakt det er.
86	og akkurat det samme gjelder også i forhold til arbeider som skjer ute.
87	Så, men jeg vet ikke noe mye mer om innholdet på det, så.
88	Ikke sånn umiddelbart, egentlig. Trur jeg har fått med meg ganske mye hvert fall i dag.
89	Nei, jeg syns det virker veldig greit, eller ålreit, eller bra.
90	Ja, altså nei, noe annet hadde jeg ikke å si noe sånt spesielt, men hva du tenkte på da?
91	Vaktlederen er ikke sjef, han vaktlederen er leder for sentralen,
92	Ellers så ser jeg ikke noe spesielt sånne ting, nei.
93	Det vet jeg ikke, altså, nei. Det er jeg ikke sikker på. Nei. Kan ikke se noe på sikt, nei.
94	Nei, ellers så ser jeg ikke noe sikkerhetsproblem her oppe i det hele tatt. Sånn sett.
95	Ja, altså jeg vet ikke annet som jeg tenker på da, også.

### *Development*

96	Å, det er sikkert mye. Vi kan aldri bli flinke nok.
97	og så skal de vel ha noen millioner for det, for...
98	De har prøvd det i England. De prøvde å...
99	De prøvde å privatisere den delen som Jernbaneverket Trafikk står for. Den prøvde de å privatisere i England,
100	, men etter tre store ulykker så gikk det private selskapet konk, og staten måtte inn igjen og overta trafikkstyringen selv.
101	Men det har vi ingen ressurser til å drive med.
102	Men vi må jo forandre oss vi òg.
103	Mye av grunnen som jeg nesten tør påpeke, det er blant annet at Jernbaneverket er pålagt å kjøpe inn utstyr i henhold til anbudsregler, hvor man da etter min mening ikke kan velge skreddersydde løsninger som man kunne hvis man hadde en fast leverandør å forholde seg til.

### *Infrastructure*

104	Altså, sånn som tuneller, det har jeg tenkt en del på.
105	Og selvfølgelig, da, på materiell som kjører, tog. At de er mer driftssikre.
106	Jeg tror det foregår på GPS
107	Jeg tror det er GPS som... Men dette er et stykke fram i tid, da.
108	Og det er på en måte den delen av Stor-Oslo lokalmiljø hvor det er tettest tog, og vi har jo mest nedslitt infrastruktur.
109	Det begynner å bli bedre, men vi har på en måte de mest gjentakende feilene i det området der, da.

## Local

110	Og der trur jeg, mener jeg at hvertfall i forhold til en veldig stor sentral, da, Oslo, for eksempel, der er det veldig rullering. De har vanskeligere for å sette seg inn i alle plassene de kjører. Utifra lokalkunnskapen.
111	Østerdalen er litt verre for det der er det så mye skog at det er vanskelig å skille.
112	Men her er det, her har du punkter å forholde deg til.
113	Ja. Nei, altså, Oslo kjører veldig mye på det vi kaller automatikk, så der er det automatisk styring av tog, eller av signal hele tida.
114	Vi bruker det her òg, men på en litt annen måte. Det har noe med togtetthet og geografi å gjøre.
115	Altså, et tog som er tre minutter forsinket da, i Oslo, da kan du bli parkert på grunn av at da er det kø med en gang. Men når du kommer oppover her, så. Vi bruker ikke de tre minuttene som en sånn punkt på å stoppe et tog.
116	Når du kommer opp til Hamar, så blir det mye lengre mellom stasjonene. Du har kanskje åtte-ni minutter kjøretid mellom hver stasjon,
117	Østerdalen, hvis du kjører der, så, i verste fall der så blir i stedet for tre minutter så kan det bli cirka 50 minutt. Hvis du tar den regelen de bruker som de bruker i Oslo.
118	Ja. Så der gjøres det i veldig liten utstrekning
119	Derfor, så sier jeg at en forsinkelse er ikke en forsinkelse hvis du ser på hvor du er hen i Norge.
120	Ja, vi sier det at vi kan ikke slakte et tog som er tre og et halvt minutt forsinket. Vi kan ikke si det at ”Nå må du stoppe og vente på neste slot”.
121	. Men femten minutter, det er passe forsinkelse for oss, da klarer vi hente inn toget nesten uten at det blir ødelagt noe mer.
122	Så det er litt forskjellig. Inngangsverdier da, for i si at toget er forsinket, selv om du får tatt inn det, står, sånn er det. Men vi har fått lov til å bruke huet.

## Miscellaneous

123	Nå har jeg vært ei uke på fri, så når jeg kom tilbake i dag, så så jeg det lå en mail på akkurat...
124	Vi snakket jo om det litt på medarbeiderskonferansen jeg var på nå.
125	Men, sikkerhet koster penger, det... Det er ikke noe du tjener penger på.
126	, at brukervennligheten er bra,
127	funksjonaliteten ute er bra, selvfølgelig.
128	Og så står det da oppslag på stasjonen om hvilket spor togene skal kjøre,
129	Det er ikke to år, men kanskje... Å, det er mer... eller ikke femti år... Ja, femti, før den tid må det vel komme, tenker jeg.... Ja, håper... ja, kanskje.
130	Men man har jo ikke noe interesse av å tape liv eller skade folk i tjenesten. Og det er for såvidt mye likt der,

## Traffic

131	. Da bruker vi huet. Og si at de tre og et halv minuttene, de må vi prøve å hente inn igjen.
132	Altså, det er jo ikke... Sånn ytre påvirkninger, så ser jeg jo ikke på noe annet som enn at folk kan hindre regularitet.
133	men da går det ut over... for de reisende går togene saktere, og det blir forsinkelser. Det er det de reisende merker det på.
134	Det her kan dessverre... Du får ikke lov å kjøre... kan du kjøre da, for du kommer ikke fram. Rett og slett, du kommer ikke fram.
135	Altså, jeg også sa det, faktisk. Jeg bor i [navn på lite sted], så jeg tok et tog... tar et tog fra [navn på liten stasjon] hver dag, og i dag så var det forsinket 20 minutter. Og det var 12 kuldegrader, og alle står på venterommet. Og det toget som jeg skulle ta i dag så var det borti 70 stykker, så det var trangt som pokker.
136	Og da... I [navn på stasjonen] går plattformen der, så ligger stasjonsbygget der, så står lok'et der, ikke sant. Og når 70 stykker da, de går ikke til tog, vet du, de løper på plattformen for å finne plassen sin, for dette er faste pendlere. Og da greier ikke toget å ta igjen noen forsinkelse. Du blir heller ytterligere forsinket.
137	Det har jo hendt her at vi har måttet innstilt tog og sånt på grunn av snøen.
138	Så, men, det er jo sånne ekstreme tilfeller, så det er jo ikke ofte at man havner oppi det.
139	Herfra til Asker, som vi har, så er det jo nesten bare natta vi kan jobbe på, for det er så tett tog.
140	Mens videre ut i distriktet, så er det jo bedre tider å jobbe på.
141	Det er ikke sånn sikkerhetskritisk, men det er som regel altså at du kan unngå en forsinkelse på et par minutt. Og sånne ting.
142	vi hører vel kanskje ikke så mye i media om vår del, og du hører stadig vekk om forsinkede tog.
143	At togene har en forutsetning for å kunne nå dit de skal i rute òg, ikke at det er satt opp ... mange ganger så kanskje det er satt opp litt dårlig tid på rutene, så har du en liten rullestol som skal på et eller annet sted, og da er det fire minutter ekstra. Og så kjører det toget, og skal krysse et annet tog, ikke sant, da blir det stående og vente i fire minutter.
144	... Største utfordringen der er jo toget foran som eventuelt har noe trøbbel, at det blir stående og vente bak det. Det er jo det som blir det største problemet da,
145	men da er det jo mye, mye friere. Da går det på en måte... Da skal det litt mer før det roter seg til.
146	. Men du ser det sånn som i Drammen nå, de har en togtetthet her på morgenen så du har vel 6 avganger på 12 minutter, sånn cirka. Og det er klart at det... hvis det første toget i rekka der da stopper... Brakerøya ligger før du kommer inn til Asker, ikke sant... hvis det da får en rullestol eller et eller annet littegrann heft, 4 minutter på Brakerøya, for eksempel, så har du de fire andre togene bak, ikke sant. Da er de på en måte sperret. Så det skal ikke mer til. Så det er veldig sårbart.
147	Det er bare utfordringen med å prøve å få alt til å gli smidig, og da er det avhengig av de ruteplanene som vi på en måte kjører etter. Togene skal gå på de og de tidspunktene og det er viktig at de er gode, da. Sånn at det er littegrann pusterom imellom og [den] kan tåle 4 minutter der uten at det påvirker

	flere tog og, litt sånn. Så det er viktig.
148	Men gjennom det siste året har jeg tenkt litt på at det er ganske, det vi trenger å jobbe med sjøl, er nøyaktighetskultur.
149	Men for å få alt på plass så trenger vi jobbe litt med nøyaktighetskulturen
150	og hvis det toget er tre minutt og tredve sekunder i Oslo så kan det blir slaktet.
151	Her så, hvis du gjør det da, så vil det blir sytten minutt, i stedet for tre og et halvt minutt.
152	Noen tog har jo kryssningsopphold. I og med at vi har enkeltsporet drift her, så er det jo endel stasjoner som de må krysse, hvor de har et opphold på tre-fire minutt. Da, hvis vi snur kryssingen der, så har du andre toget først inn, og så er begge togene i rute. Det er lov å bruke huet.
153	”. For, i Oslo skjedde jo det, for der er det noen, for der ligger det spesielt gjennom Oslo-tunnelen, da. Der er det jo tungt å komme igjennom hvis du er forsinket,
154	og hvis du da kjører det toget forsinket så vil alle togene bli forsinket.
155	Så du har jo deler av teknikken her som er på deler av dagen så ser vi at hvis et tog fra Oslo er ti minutter forsinket, så må vi ta et valg, enten så må alle bli ti minutter forsinket eller så må vi gjøre noe med det toget da.
156	Er det en fire-fem minutter ødelegger det jo mye, hvis vi begynner å røre det.
157	Så det tar tid å stoppe et så langt tog, og hvis han da må bremse hardt sånn at toget stopper, så taper’n masse tid.
158	. Så dess større togettetthet det er, dess mindre gjør vi av sånne ting, da. Lar heller da trafikken stå til feilen er reparert.
159	Nei, for nå så er det faste signaler, ikke sant, så en blokkstrekning er derfra til dit, men i den framtidige måten å framføre på, så flyttes den, ettersom toget kjører, ikke sant. Det blir mer fleksibelt, da. Hvis vi har dobbelt spor, da, så kan du kjøre tog kanskje tettere.
160	Ja, nei da kan man jo ikke øke aktiviteten,
161	A la modellen verre (...Umulig å tyde [21:41]). Dette her er ingenting vi har hatt nå første dagene her.
162	Nei, det er noe. Men litt forskjellig snømengder, ligger litt her og der, da, så
163	... Det som har vært mest av snøutfordringer nå har vel egentlig vært kulda, egentlig, for togoperatøren. Ikke så mye for vår del.
164	Så det blir verre når det kommer litt lenger utpå vinteren og får mer, større mengder med snø.
165	. Det har kommet forholdsvis lite i Osloområdet blant annet.
166	For et par vintre sida så hadde jeg Østfoldbanen og... styrer jo fra Ski til Kongsvinger grense og over Fredrikstad, Sarpsborg og nedover der, det er jo en strekning som har et tjuetalls stasjoner og da var det sånn snøværet som det var nå i helga.
167	det var mye mer i Drammenskanten og sånn vi merka det, og det var da sånn ti-tolv kuldegrader og femti cm snø i løpet av et døgn, og det blåste sånn [horisontalt] ... og det var føyke overalt.
168	. Og føykesnø er det verste som en (... generelt? [26:25]) klarer, uansett hvor mye bra mannskaper, varme og alt mulige greier, det klarer man ikke å håndtere. Du renser og gjør noe, så går det tjue minutter, så er det blåst igjen. Ikke sant, og da er det game over før du aner ordet av det,

169	. Og da var det 3-4 sånne snølag ute overalt, og de jobba overalt hele tida, og det blei liksom ikke noe bedre. Du bare går og stamper i motbakke.
170	Du har en stasjon som heter Dal, på Øvre Roabanen som ligger rett nordafor Jessheim. Den vet vi at det ved visse situasjoner der så må vi passe på for eksempel hvis det kommer godstog nordfra, den må vi passe på ikke stopper på innkjøringa til Dal, siden at der vet du at det er dårlig føre, regn eller snø eller løvfallstid på høsten, så kommer ikke det i gang igjen. Og da står toget der, og du har signal og det kommer ikke inn,

### Work

171	, alt ekstra påtegnes her i tillegg og leveres inn til togleder kl tre, senest kl. tre i dag, det som gjelder i morgen da. Så vi får hele tiden en frisk oppdatert grafisk rute å jobbe etter.
172	For det som er tegnet på den, som er trykt med svart og tegnet på blått, det er jo sånn det blir overlevert fra rutekontoret til oss dagen i forveien, kan du si.
173	klokken halv fire så er det de som sitter på rutekontoret her. Da har de klargjort det vi kan få morgendagen. Da leverer de den grafen for morgendagen inn til vaktlederen, og så klokka tolv da så begynner driftsdøgnet. Og da begynner vi med ny graf som de har klargjort for...
174	Men det er jo ikke alltid de kommer.
175	. Men at det at vi er såpass små og oversiktlige da i forhold til Oslo i hvert fall, men vi har jo togledersentraler som er enda mindre enn det vi har, så ...
176	. I tillegg så har vi en del andre krav, som går på punktlighet, nøyaktighet, og rapportering. Såne ting
177	og vi har en relativt stor enhet rundt hvordan regelverket er ment å skulle være. Det trur jeg òg er veldig gunstig. Det trur jeg er flere fordeler her hos oss ja.
178	, fordi at vi er jo den som alltid tar avgjørelsen på hva vi tillater andre å gjøre eller ikke.
179	Vi kunne kanskje kommunisert det bedre ut.
180	Derfor så er det er oppfatningen ute blant vanlige folk er ofte at en del av tingene vi gjør er liksom tilfeldigheter da, det er det jo ikke.
181	Sånn er det fint her, for her rullerer vi hele tiden.
182	Vi har ikke et overvåkningsplikt på den måten at vi må sitte og stirre hver enkelt skjerm hele tiden. Det har vi ikke.
183	Det har de som flygeledere. Der har de overvåkningsplikt hele tiden, at du må sitte og se på skjermen.
184	Men de har jo ofte litt annen turnus enn vi har. De er vel ofte to timer på, og en time av, her sitter vi jo åtte timer på. Det er litt forskjell. Så overvåkningsplikten er ikke lik.
185	Vi har vokst ut av lokalet. Vi har for mye utstyr i forhold til det arealet vi har takler.
186	Det er det samme som å kjøre bil. Bortsett i fra at her er det en system på det. Som jeg også var innom i stad, det er ingen tilfeldigheter det vi gjør.
187	Så setter jeg meg inn i det
188	Sikkerheten da operativt, for å si det på den måten, da, det foregår jo på den måten at jeg styrer jo sikringsanleggene, fjernstyrer sikringsanleggene...

189	Ja vi overvåker jo... Vi følger jo med på skjermene våres på togene. Overvåker
190	Begge to, ja. Og da får vi det som vi kaller for ”belegg”.
191	Den blir fortsatt som den er omtrent som i dag.
192	. Så jeg tror det blir veldig lett å dette [anm. falle] inn i det systemet.
193	altså måten vi jobber er jo at hver arbeidsplass er delt inn i strekninger, for eksempel har du hele Kongsvingerbanen fra Lillestrøm til Charlottenberg, grense mot Sverige.
194	I tillegg så er det en del nøkkelstasjoner hvor du er avhengig av at sporveksler går, slik at du får toga fra ytterspor til innerspor og litt sånn forskjellig. Og går ikke det som det skal, så er det jo enten å få noen folk til å rydde i sporveksleren slik at de går som de skal, eller så må man framføre togene muntlig kjøreordre, og det betyr at du setter i gang en annen sikkerhetsprosedyre.
195	Da var det ei morra jeg drev å jobba nattevakt, og når morratrafikken skulle begynne, så hadde jeg vel av tjue stasjoner som og driftsplasser som jeg brukte, og av de tjue så var det en sånn tolv-tretten vi vanligvis bruker til å endre spor på og litt hit og dit og møte tog og forskjellig, og på den tjue stasjoner lange strekninga da så hadde jeg vel 4 stasjoner som fungerte normalt.
196	Så har vi jo grafer da, som er et papirverktøy vi også bruker mye.
197	Grafene, det er en toggraf, det er egentlig alle togene tegnet inn på en graf.
198	Ja, så har du klokkeslettene og stasjonene og kilometeravstandene, og er det forsinkelser så skal du ta og tegne inn hvor mye [de er] forsinket, så får du sett hvor de møter neste toget og alt sånne ting.
199	Ja, den er et veldig fint verktøy.
200	Lenger nord. Det ligger innenfor stasjonsgrensen på Hamar.
201	Det er et privat bygg som Jernbaneverket ønsket å leie
202	Vi vil... Men da går det aldri bane rett forbi her
203	Ja, det ligger ved... i denne enden på stasjonen.
204	Det er mye episoder, eller du kan ikke kalle det episoder, men, det skjer jo ting ute i trafikken, dette endrer seg jo fra dag til dag, og du kommer opp i nye situasjoner.
205	. Det er jo snakk om (...) å kanskje flytte sånn som elkraftsentral og sånne ting, og kanskje ha den, holdt jeg på å si, på en egen lokasjon,
206	Det er lokaler der som vi ønsker gå inn i, da. Kanskje? Neste år. Håpe det ihvertfall