

Swedish case study - Safety Rule Management in Railways

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1 Introduction

1.1 This report and study

This report gives a summary of the Swedish part in the SAMRAIL project. Information about the model and method is included in order to make the report understandable without having access to the other reports.

This study is a part of larger European project Safety Management in Railways - SAMRAIL. This report concerns a specific workpackage called "*Regulations, Roles of Rules and their unification*" (WP 2.8). Project information can be found on the web-site <http://samnet.inrets.fr/>.

Case studies are carried out in Denmark, the Netherlands, Sweden and United Kingdom. The objectives of these studies are to compare the situation concerning development, implementation and evaluation of rules designed to promote safety in railway organisations in different European countries. Further, they will explore the usefulness of a theo-

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retical framework developed in WP 2.8.1, by comparing this "ideal" process with what actually happens, identifying examples of good and bad practice and allowing for revision of the framework

In Chapter 2, there is basic information about the Swedish system and the persons who have been interviewed. In the sections 2.4 - 2.6, there is a summary of issues and questions which are not related directly to the framework. In Chapter 3, the answers have been summarised according to the model. The results are then discussed and conclusions made.

This case study is not intended to be very profound in describing the Swedish system or its potential problems. The report here merely summarises statements obtained in the interviews. They are in some cases contradictory, or least represent highly different views. It should also be pointed out that only a few people have been contacted, so there is no guarantee that the results represent any definitive truth. However, some of issues might be worth to investigate further, but that would be a different study.

1.2 Rule management framework

Definition of rule

A general definition is that "a rule is a correct or preferred state of the system, or way of carrying out a task in defined circumstances to achieve a defined goal". The framework presented (Hale et al, 2003) confines itself largely to the management of written rules. These can be formulated at a number of different levels of specificity.

- They can specify exact behaviour or states of the system (protective equipment to be worn, exact specification of warning signals, etc.);
- They can specify goals or general principles to be met (risk "as low as reasonably practicable", "safe construction", "state of the art engineering"), or
- They can be formulated to specify what process has to be gone through to arrive at the correct behaviour or state (risk assessment procedures, safety case requirements, Permit to Work procedures, etc.).

Depending on the type of application, there can be different types of aims with the rules:

- Give compulsory rules for workers, drivers, traffic controllers etc.
- Provide guidance for such staff, from which they can deviate if they have good reason.
- Define responsibilities for organisations and people.
- Support cooperation between organisations.
- Support control and monitoring.

There are sets of rules at different organisational levels in the railway industry:

- National rules may be devised for all actors
- Each operating company (or organisation) has a set of local rules.
- There may be agreed rules for cooperation between organisations (infrastructure and operating companies, principals and contractors, etc.)
- Within the organisations there are rules for management processes and for direct on-line control of risks

Ideally all of these sets of rules should be compatible with each other; the lower system level rules being derived from the higher level rules.

Although this framework is appropriate for all types of rules, the main focus in the SAMRAIL project is on operational rules for those directly concerned with the primary operational and maintenance activities.

Rule management model

A generic model (Hale et al, 2003) of how safety rules should be managed and improved has been used to structure this investigation. The model was composed of nine main elements (blocks):

1. Define processes, scenarios & controls for the activity
2. Choice of controls where rules are necessary
3. Develop and write applicable rules
4. Approve rules
5. Promulgate, train, execute
6. Monitor use of rules
7. Evaluate rule effectiveness, errors & violations
8. Enforce use of rules
9. Modify rules.

There are also external requirements from various stakeholders. The model contains feedback from the elements 6 and 7 to some of the other elements, especially to 2, 7 and 8. In the activity (6) *monitoring*, information is gathered about how the rules are used and by whom, and also identifying any deviations and the reasons for them. Based on the monitoring of the rules (7) *evaluations* are made, whether the rules are appropriate for the given situation and what may need changing.

1.3 Method

The collection of data has been based on interviews with persons with different positions in railway organizations. The interviews have been semi-structured, and based on a common interview-guide. This guide provided central questions and identified important issues for consideration during the interviews, including which actors are involved in which stages of the process. The persons being interviewed have had opportunities to make comments to notes from the interviews and to a preliminary version of this report. Only few corrections were given.

The case studies have been related to situations of planned infrastructure maintenance, as this is an important safety critical task that gives rise to significant hazards. It has focused on the transfer from normal operational mode to degraded mode and back to normal mode again.

In Sweden, we have chosen to focus on planned maintenance on one track of a double track line. An additional scenario, when the job takes one extra day in relation to the planning, was discussed in the interviews.

As examples of rule management, we have chosen two rules. The first is in the stage of rewriting, and its subject is planning of safety when people work on or visit the track area. This rule replaces an older rule (BV, 1996). The second example (BV, 2003) is an amendment to the general safety rule set and has recently been promulgated. (See also Section 2.3.)

1.4 About the Swedish railway system

Banverket (BV) has overall responsibility for the entire railway system in Sweden. It has approximately 6 500 employees. The organizational structure is complicated, and it is divided in several organisational entities with different roles.

The main responsibilities of BV are:

- Ownership of large parts of the Swedish railway infrastructure.
- Manage maintenance of the infrastructure
- Controlling and planning railway traffic "Banverket Trafik"

- Development of rules for the railway
- Approval of time tables (independent organisation within BV, Rail Traffic Administration, "Tågtrafikledningen")
- Railway inspectorate (independent organisation within BV)

The Head Office and five railway regions (Track regions, "Banregioner") have administrative duties. There are also production units that provide production and services within the railway sector after procurement or ordering.

The train traffic is run by a number of independent (from BV) operators.

Since a number of years, a large part of the Swedish safety rule system for railways is being rewritten. We have not included this change of rules in this study. The main reasons are that it would require a too large effort to investigate this, and that results and experiences are not available yet. This change process is so far mainly concerned with *Block 3 - Develop and write applicable rules* in the framework model.

2 Results - basic information

2.1 The interviews

Interviews have been made with nine persons. They have been selected to represent different aspects and interests on rule writing and on their application. Organisations engaged in maintenance work were represented by three people at different positions at one specific company.

- A) The planner made the overall planning of a geographical section of the maintenance company (which is also divided in larger geographical regions). He planned for about ten supervisors and their service teams.
- B) The supervisor planned the jobs for technicians in his service team.
- C) One technician who did the practical job, and he was the one at risk. This person was selected because he also was safety representative for the technicians.

On a more planning (or strategic) level we had:

- D) A person planning maintenance work at a regional level in BV.
- E) A safety official within the company at the same regional level.
- F) From a train operating company, we interviewed a person in senior staff position with responsibilities for safety and accident analysis.
- G) A safety controller represented the traffic planning at regional level in BV.
- H) Project leader at the Head office of BV.
- I) Safety specialist also at the Head office of BV. Both H and I worked with issues of safety management, and were responsible for developing rules on a national level.

All the persons we asked for an interview said yes, without hesitation and without asking superiors about permission for that. In two cases, we had to cancel interviews but that was due to problem with finding a convenient time. They have all got a summary of the interview with possibilities to make corrections. About half of them wanted to make slight changes of the wordings.

The interviewees had a long experience from the railway, and their length of service was between 15 and 33 years.

The persons H and I are directly involved in writing rules on a national level. F and G are occasionally engaged in rule writing within their company or regional area.

2.2 Rules about safety and maintenance

General

There is a large collection of rules related to maintenance and work in the track. Rules on a national level which have been discussed during the interviews are:

- (a) *General Safety Rulebook* (BV, 2001), usually referred to as SÄO. It is the general rulebook which is supposed to cover most of the safety aspects for train operations.
- (b) *Protection and safety* (BV, 1996), referred to as SoS. It concerns workers' safety on the track and planning aspects.
- (c) *Temporary speed reduction* (BV, 2003). It gives some specific rules for speed limits and communication about this, at certain situations.
- (d) Electric safety legislation and corresponding regulations
- (e) Work environment legislation and corresponding regulation.
- (f) Law about working hours

(a), (b) and (c) are special rules for works within to the railway industry. Connected to these rules, there are also forms which have been mentioned above.

- S-form¹
- S-log-book
- SoS-plan, related to rule (b)

There are also collections of rules both on the regional level and related to the different organisations. They are often an adaptation of national rules to the specific organisation, or a way to find a practical solution.

Changing of rules

The General Safety Rulebook (a) has been in the process of rewriting for the last years. We have decided not to analyse this changing procedure according to the framework model. One reason is the size of the book (many hundred of pages). Further, these changes are still in preparatory stage, and there is not enough information about the outcome.

In this study, we have chosen to discuss the rule (b) *Protection and safety*, which right now is in the process of being rewritten. It has fairly short (34 pages) and has a more limited scope.

The other example is the (c) *Temporary speed reduction rule set*, which has recently been changed and promulgated.

2.3 Maintenance work

Types of jobs and planning

In relation of maintenance, there are five types of jobs (A-, E-, L-, S- and C-jobs), and also travelling with working machines and vehicles are related to maintenance. Two modes of maintenance work planning can be distinguished, which are "*pre-planned jobs*" and "*direct planning*".

Pre-planned jobs

Pre-planning is a procedure where many different jobs are planned. Several organisations are involved and many procedural steps are included with proposals, approvals etc. This

¹ "S-blankett"

planning is done in a 8 weeks perspective. The result is an official plan for access to tracks. The plan is given to the maintenance companies concerned, which distributes it to planners and supervisors.

The concrete job is then done by technicians who get formal access to the track to do their job. This is regulated in a distinct procedure and documented in a form (S-blankett). There is also a safety and security planning which shall be documented on another form (SoS-plan). The procedure also gives advice how the system is put in normal conditions after the job.

This procedure is prescribed in rules on the regional level, which might vary along the country.

Direct planning

Another mode is called "direct planning", which is used when the pre-planning is not applicable. It can concern acute failures of the infrastructure, or if certain job is delayed. There are some different practices applied and they vary between different parts of Sweden.

In the scenario, when the job is delayed one day, it is sometimes possible to apply a defined routine. The supervisor uses a form "deviation from track planning", which makes the situation similar to pre-planned jobs.

This planning can also be made in direct dialog with a train-dispatcher and the worker on the track. Formally all technicians with certified competence are allowed to handle this type of dialog. They are supposed to document this in designated log-book.

2.4 About the planning procedure and operations

General

The answers from the interviews show that there are many different views on the present planning procedure, both how it works in practice and how it should work. The long term planning with a 8 to 4 weeks perspective is usually called "preplanning". The quicker planning (from days to minutes) is called "direct planning".

There is a formal interface between the traffic planning office and the contractors, who are doing the job. There is a special form (S1, S2 or S15), which gives the official permission for work on the track. The closure and opening of the track is done by communication between a train dispatcher and a designated responsible person on the track at the contractor. In the "direct planning" mode, the "S-log-book" (see Section 2.2) is supposed to replace the S-form.

The planning is concerned with who shall have access to the track at certain times. Since this a limited resource, there are obvious conflicts here.

Regarding the planning of maintenance, there are different routines in Sweden between regions, and also within regions.

The perspective of maintenance people

From the practical maintenance perspective, the planner (A) makes the overall planning for a number of supervisors. The concrete operational planning for the technicians on the track is done by the supervisor (B). In the early preplanning stage, he is supposed to estimate how long time a specific task will need. This planning can be complicated, and involves often changes and corrections.

The planning horizon becomes much shorter than the assumed ideal 8 weeks. One example is that planning process is delayed at intermediate organisational levels. One of the interviewees described the situation as that most jobs become "acute" and improvised.

The technicians (C) doing the practical job need to check that the work order is in accordance with the reality at the workplace. They also need to secure that safety precautions are taken. In the planning stage the supervisor. Also the technicians are supposed to estimate how long time a job takes.

From the technicians' perspective, there are in many situations difficulties to follow a strict and rigid plan. This results in common changes, which give rise to a need for a "direct planning" in cooperation with the train dispatchers. In practice, there will also appear a number of violations of rules further discussed in below.

The feeling of the safety representative (C) was that the procedures and routines for planning had traffic operations in focus. Preventive maintenance gets lower priorities for access of the track, which might increase the risk of errors and mistakes at work.

The perspective of the track owners and users

The demands for time on the track come from the companies who are contractors for maintenance work. The track owner (D and E) representatives emphasize the need for a long planning period. The reasons are that it should give enough time for safety planning, and for balancing against other interests.

The planner (D) at the track owner office has the impression that contracting companies ask for permission for too many jobs on the track compared to what is actually used. In that way the capacity for other maintenance jobs and for extra traffic on the tracks is reduced.

For the train operating company (F), maintenance work involves reduction of speed and production disturbances. Some changes affect the train drivers and information needs to be transferred to them.

The traffic planning at regional level representative (G) also points at the importance of "pre-planning". They can then have more resources and extra people at extra high demands. The longer time perspective helps in correcting time tables.

The head office perspective

The head office perspective is that the share of "direct planned" jobs is too high, and that preplanning should be used to an even larger extent. Preplanning is to a growing extent seen a part of the safety management.

There is also an order from the director-general of BV that work on the track shall be preplanned. This is based on experiences of a death accident during 1998.

2.5 About handling of unplanned disturbances

General

In the questionnaire, two scenarios have addressed. The first concerned the normal planning of maintenance. The other scenario was based on the assumption that the planned job took one extra day, which was found out rather late. The different modes are presented in the sections 2.2 and 2.4.

However, this type of prolonged job seems in a way to be a part of the normal variations of the jobs. It comes close to aspects related to the so called "direct planning" (see above). This question raised similar issues as for the "normal" planning.

Here, some additional remarks coming from the interviews are summarised. There have been comments from maintenance people and track owners and users, but not from the head office.

The perspective of maintenance people

If a deviation is foreseen, the planner (A) at the local level, or supervisor (B), can fill in a special form¹ for request of deviation from the plan. It is a routine for the particular region, it is based on a recommendation from the head office. It is not a formal safety routine, and it is not examined by e.g. the Railway Inspectorate.

If the delay concerns something that can wait without problem, the job might be suspended up to eight weeks. Otherwise the job will be arranged in some way. The supervisor (B) also points at the opposite problem, which means that access to the track is not obtained at the planned time, which gives problems in getting the job well done.

The technician (C) means that it has become harder to change plans and get access to the track. Sometimes it works and sometimes not. If it is too troublesome, they try to solve the problem outside the formal system - some kind of violations.

From the technicians' perspective, there is a problem with fewer train dispatchers. These sometimes do not have capacity for changes of plans. C sees this as a sub-optimisation, where money is saved on fewer dispatchers at the cost of more difficult and perhaps deteriorated preventive maintenance.

The perspective of the track owners and users

The track owner office is not directly involved in these changes of plans. The planner (D) has got an impression that contractors use that type of planning in a too large extent. There is a difference between different geographical areas to what extent this is permitted or not.

For the train operating company (F), the shorter available time reduces capacity and quality. But, it does not increase the level of risk.

The operative manager at the traffic planning decides, if it necessary to block the track for continuing the maintenance job or not. He weighs in several factors, and if the problem is acute there is no real choice. The handling of this kind of issues is not regarded as an essential problem.

2.6 Answers related to the rules

General

A summary of relevant rules is given in Section 2.3, and of special interest are the rules (a), (b) and c). The first, the General Safety Rulebook (BV, 2001) (SÄO) is the basic set of rules. We mention it here because it is the bible, but we have not studied the changes of it here.

There is demand for certain categories of employees to have their knowledge about the SÄO examined every year. This is combined with a training session to keep their knowledge up to date. All supervisors and technicians, with positions similar to the ones we have interviewed (B and C) belongs to this category. Also train dispatchers and train drivers follow such a program. There are not similar formal demands for any of the other categories we have interviewed. However, several of them has pointed out that they have knowledge anyway.

¹ "Begäran om avvikelse från BUP"

The perspective of maintenance people

All three interviewees (A, B and C) agree that SÄO is their general guideline. It is the basis for the planner (A) to use the S-form (see Section 2.3). The supervisor (B) and the technician (C) do not look in the rulebook in their normal job, but both mean that they know it well. The questions at the test are not so difficult, unless they become formal and ask about wordings etc.

The rule (b) *Protection and safety* (BV, 1996) is being rewritten and is a part of the study. Here we have asked about how it is used and seen. Also here we have an agreement - it is not used in reality.

The technician sees it as unpractical and as "product of the drawing board". He also gives the same opinion about the related form for Safety planning (SoS-plan, related to rule b). If the form is used, it is seldom filled in correctly (according to A and B).

These interviewees also point at the fact that there are also many other rules, standards and documents that must be fulfilled. Examples mentioned were rules for welding and for checking and repairing signalling systems.

The rule (c) *Temporary speed reduction* (BV, 2003) was not discussed with the maintenance people.

The perspective of the track owners and users

The person (D) planning maintenance work at a regional level in BV means that SÄO not directly addresses him, but it is useful for him that he knows it well. The rule (b) *Protection and safety* (BV, 1996) is not an "active document", but the planning office expects that contractors shall know it and give them copies of it.

The planner (D) points at the situation with many actors working on the same track and risk area. There are is requirement of coordination in the Work Environment Law, which is a demanding task. At present, there is no overall policy or routine for coordination. He also mentions obscurities in SÄO about how delegation and transfer of responsibilities should be handled. There is no clear guidance there either. The safety official (E) at the same company has mentioned that there are situations which are difficult for the people in the field to handle (especially at electric related hazards¹).

The regional district has designed a special routine for the planning of maintenance work. Its aim is to make a local interpretation and application of the general rules in SÄO. One problem (according to G) with this routine is that changes are heavy and difficult to make. That makes disturbances more difficult to handle, and it creates problems with the mutual understanding between planners and people who make the practical maintenance work.

The head office perspective

From the head office perspective, there are three main types of rules:

- 1) Directions with compulsory rules decided by the Director-general.
- 2) Standards with compulsory system demands, which are decided at a lower level.
- 3) Handbooks, which are advisory.

¹ E-arbete

There are operative rules and technical rules. These address different but complementary parts of the systems safety. Regulations are to a large extent detailed and there are:

- Technical demands on the installation after concluded maintenance.
- Rules how jobs shall be performed
- Rules for safety and protection at jobs.

One aspect is that written rules are important to give a clear picture of who is responsible. In practical use, small "remember-cards" is main the written information about safety rules. The rules often defines when deviations can be made, and who is authorised to decide about this.

Operative safety rules will always be needed. There is an ambition to reduce the prescriptive rules and enhance the degree of goal orientation. The aim for this is to give flexibility for development of procedures and to obtain an improved efficiency.

The head office has an ambition to monitor that personnel has a suitable competence, and by this reduce the need of rules at a detailed level.

3 Results - related to the framework

3.1 General

In this chapter, the obtained answers are directly related to the framework model which is described in Section 2.1.

The focus of the discussion is now on the two selected rules (see Section 2.3):

- Rule (b) *Protection and safety* (BV, 1996), usually referred to as SoS. It is now being rewritten, and it relates to workers' safety on the track and to planning aspects.
- Rule (c) *Temporary speed reduction rule set* (BV, 2003, which has recently been changed and promulgated.

3.2 Definition and choice of controls

General

This section discusses the two starting blocks in the framework: Definition and choice of controls (1 and 2).

1. Define processes, scenarios & controls for the activity

The proposed rail process, which has to be controlled, needs to be properly defined and delimited. The process may be a new one, or a modification of already existing ones. The model assumes the modelling of the process, system transitions (e.g. from normal running to emergency mode). This step defines what must occur in the system for it to operate safely and what must be prevented.

2. Choice of controls where rules are necessary

In this block it has to be decided how the desired states or behaviour will be achieved. The desired behaviour can be imposed on the system actors in one of the following ways: technical forcing functions, administrative standardisation in the form of defined and imposed rules, self-control through expertise and competence based on practice and acquired knowledge, and social group regulation.

Head office answers

A general comment to both rules (b and c) is that Banverket (BV) has several tasks. This means that BV develops and formulates the rules, and then also approves and applies them.

For rule (b) *Protection and safety*, there are descriptions of the processes both for planning and for accomplishing the work. There are five different general types of jobs. These types of jobs (operational modes), the transitions between them and return to normal operations are described in the already existing rules. In this rewriting, change of principles and means of controls were not seen as relevant.

The other example (c) had the aim of strengthening and giving more precision to reduce speed of trains at certain situations. How the blocks 1 and 2 in the framework come in here is hard to assess.

3.3 Developing rules

General

The next block in the framework is: *3 Develop and write applicable rules*. After it has been decided which controls are appropriate, the corresponding rules must be developed. The type of rule should be decided upon, i.e. a specific rule allowing little interpretation, a procedure for arriving at the correct action or state, or a general goal. This must be seen in relation to the existing rules, if this is an addition to the rule set.

Head office answers

Both interviewees are engaged in rule-writing. They have described rule-writing processes, which differ to some extent. The differences might be explained by that this is more a praxis than a formalised procedure. One procedure includes:

- Identification of needs
- Collection of facts
- Analysis of consequences
- Rule-writing
- A round, where the suggested rule is circulated to stakeholders for comments
- Corrections.

The other alternative to describing the procedure is:

- Pre-study
- Feasibility study
- Accomplishment
- Evaluation

Looking at Rule (b), the stakeholders involved have been some sections of BV, especially departments for Work Environment and Electric Safety. Also other organisations and users have been addressed, and the number of interested parties has been high.

What has gone well is that the new set of rules will be in agreement with the actual situation in the railway system. Another mentioned advantage is that the coordination role of BV has become accentuated.

One advantage in developing this rule would be to have more clear goals for the writing of rules and better defined responsibilities between different entities at BV (the Rule b covers a number of different areas of responsibilities within BV). The cooperation with

the railway area as a whole could have been better. There were many letters with comments to the suggestion, which in a way has been seen as both good and bad.

A conclusion from example (b) is that when changes are required to be done in a short period of time, there is a need for improved routines.

Other rule writers

Also three other of the interviewees have been involved in the writing of rules. In their cases, it meant an adaptation to their organisation or region. The most common is that rules come from the head office of BV, and that they should be reformulated to adopt or give a higher level of accuracy. Sometimes this is quite straight forward. In more complicated situations some kind of workgroup is established, if needed other organisations are involved in this. Alternatively, this rewriting can be seen as "promulgation" which is Block 5 in the framework.

Another situation is when the organisation finds out that there is a need to complement existing rules. One example is regulations for a specific shunt yard, which were developed and written as cooperation between a number of stakeholders.

3.4 Approve rules

General

Block (4), approval of rules, can iterate with the development block, and it tests the draft rules for appropriateness and applicability and ends with some form of approval for application. There may be an explicit role here for external authorities. One specific question was how the workability of the rules is assessed.

Head office answers

The regulation (b) *Protection and safety*, which is being developed, will be approved by the Director-general. The workability is controlled by sending out a draft version to all relevant sections at BV, and to other affect organisations in the railway industry. This procedure is still going on for rule (b). The approval procedure is considered as working well in general. One problem mentioned is that many of the answers about the draft version have not been of a satisfactory quality.

Other aspects

The other interviewees had no particular views on the general approval process. However, some of them remarked that the rule example (c) about *Temporary speed reduction* had some defects, which had passed the approval.

3.5 Promulgate, train, execute

General

In the framework model, the aim of Block 5 is to get out the rule in practice. Activities are to inform and train those who have to carry out the rules and to ensure that everyone is aware of them and of any changes made to them. Decisions have to be made about what to include in training, what in rulebooks and other means of access to the full set of rules. It must also be decided what media to use for promulgation. The execution stage also covers the processes by which the rule-users have to decide which (set of) rules is appropriate for which situation they meet and how exceptions and unexpected situations will be dealt with.

Head office answers

There is a system for distribution of new and changed regulations, standards and handbooks. The responsibility for application of the rules are transformed hierarchical down in the system

Training material and materials for test of knowledge is developed by Banverket for electric and traffic safety rules, but not for other areas.

For traffic operators and contractors, the distribution and application of new and revised rules is regulated in formal contracts. In general, this is regarded as a good model to transfer demands and enforcement of rules. However, improvements can be made to routines for promulgation of acutely needs to change rules.

The rule (b) *Protection and safety* is not yet ready, and experience is not available yet.

Maintenance aspects

When new rules come out, the relevant section at BV shall inform the contractors about this. Each contractor shall in turn inform his staff. It can be problems, if someone in this chain assumes that the next link already knows about this. The information will then be incomplete. There are many different contractors, and information might be lost due to a number of reasons.

It appears as that the main source of information to people on the track is the yearly training sessions.

Train operating aspects

The train operating company appeared to have a more strict and comprehensive system for promulgation. One early judgement is whether the rule needs an adaptation, or if it can be distributed as it is. If this is made, there is a defined routine for approval by a superior to the one who rewrote the rules.

Sometimes, the reformulation is done for certain categories, e.g. train drivers. The computer system in the company can be used to reach driver with the relevant information. There are plans to have this feature also for other categories.

One recent example is rule (c) *Temporary speed reduction*. The promulgation included an adaptation to the system of the company, which meant writing and approval of the changed rule. It should be distributed to thousands of people in two days. This was done through a printed version to each driver, and also in computer system to which all drivers have access. On the document, there was also a telephone number which could be used for support.

There were two main problems in this promulgation. The first was a very short time from when the demand was available for the company until it should be applied - around a week. The other problem was that the rule was regarded as unclear and with possibilities for different interpretations. A number of train drivers called and wanted more information about this.

Traffic planning aspects

Also for the regional traffic planning organisation, central rules need adaptation to regional situation. A plan is made for promulgation and application. Both information and training demand quite a lot of time.

Often, a new rule will change or replace earlier rules. Sometimes this can be problematic, and it is not self-evident how you "clean out" the older rules.

Also traffic planning was affected by the example on rule (c) *Temporary speed reduction*. One problem was the short time for accomplishment. It came during summer holidays with a minimum of staff available. Another complication was that the regulation was hard

to understand without information and training. Many train dispatchers made the interpretation that the rule was in contradiction with superior *General Safety Rulebook* (BV, 2001).

One comment was that the rule had been discussed during more than a year without getting an approved result. And then suddenly, it was rushed giving trouble with promulgation and the contents.

3.6 Monitor use of rules

General

In the framework model, there is the activity (6) *Monitor use of rules*. Once the rules are introduced there will be a period of monitoring the rules, gathering information about how the rules are used and by whom and identifying any deviations and the reasons for them. This goes on in parallel with enforcement (Block 8)

The first results from the interviews is that this part of the model is not relevant for Swedish rule management. There are no plans for monitoring new rules for specified time period after the promulgation.

However, the monitoring of rules is very essential and many activities exist, but not related to introduction of new rules. In this section, the monitoring is seen in a wider sense also looking at already existing rules.

Head office answers

There is no general system for a regular control of how well rules are working and followed. Audits and analysis of accident investigations are made by the head office. Accident investigations are made on a regional basis. There are also demands on the contractors to make internal follow-ups and to have a safety management system.

These activities give a picture, however incomplete, of how the rules work. It is considered to give satisfactory basis for improving the rules. Seen as more problematic is the implementation of rules and the control that they are followed. One complaint is that the supervision of the Railway Inspectorate does not give much improvement, due to insufficient systems perspective.

Maintenance on the track

At the practical maintenance level, the planner (A) had the impression that only little monitoring and supervision exist at present. The local manager and supervisor might be responsible, but they do not do this regularly. Some years ago, a safety official made checks regularly, both of how jobs were made and of the documentation. Since he left, this is not done.

In A's experience, there is sometimes (about once a year) a need to violate the rules to do certain jobs, which then is carefully planned together with the manager in charge. This type of problem is not reported up in the system.

The supervisor (B) does not do any regular monitoring of how rules are followed. One reason is lack of time. There is a general computer system for reporting incidents and problems, but his impression is that nobody uses it.

The safety representative (C) means that the basic monitoring is the yearly training combined with a check that all technicians have a good practical knowledge about the rules. Earlier, there were people in the field checking that the jobs were done safely, and that the documentation was made correctly. This was regarded as very positive, but now that has been discontinued.

C describes a number of deviations and violations from the official procedure. For example, the form "*SoS-plan*" (Section 2.2, related to rule b) has been not used in practice for quite a time. The planning is done but not documented. Another deviation is that safety leader (SoS-ledare) is not formally designated in advance. This is solved by an informal agreement on the track, and all technicians involved have an approved competence to be safety leader.

A third example on deviations was given. At temporary jobs, the planning "S-form" (S-blankett) is not used. The reason for this is that the technicians are at many places each day, and it would be too awkward and too time-consuming to do this every time.

These deviations are often motivated by production reasons, and "when you are on the track you want to start with the real work". The technician C emphasized that they do not sacrifice safety by these deviations and violations. He meant that they work carefully and safely.

Both the supervisor (B) and technician (C) regards the period before and after the real job is done as the most dangerous situation. The persons are then less careful and might be overrun by a train.

The supervisor (B) especially points at the planning stage before the maintenance work is done. People are moving around in the danger zone but without blocking the traffic. This inspection situation is a grey-zone – shall it be regarded as a "real job" with all safety precautions.

B is aware of that short cuts are made in the planning on the field. The hazards with improvisations increase, especially when there are changes in the time table, when directions of train traffic are changed, and when several tracks run in parallel.

Track owner aspects

The general planner (D) has no own responsibility for monitoring. The contractors have a high degree of independence, and D does not have a real check of what they are doing. The checks of how well jobs are done etc. fall on other parts of the organisation. And in a way he also feels uncertain how well contractors follow regulations, and how well the actual jobs are done. From this planners' perspective there is no feedback of results from the field and the practical achievements.

The safety official (E) at the same regional level is supposed to make controls. He visits preplanned jobs around five times a year, and make other rather spontaneous inspections round 15 times a year. These checks usually find a number of defects, e.g. lack of warning clothes or unsatisfactory warning for trains. When finding faults he informs the supervisor, or sometimes the job is stopped. There is no system for how controls should be made, or how negative results shall be reported and handled.

The check of functions of the technical equipment being repaired or maintained is done by engineers in another part of the organisation.

Train operating aspects

There is a system for reporting incidents and problems. Drivers and others report to their supervisors, who will enter the information in the computer system. For example, too high speed is defined as an incident.

It appears as that the reporting about vehicles and equipment works well. However, reporting which concerns traffic and operational problems, as well as complaint from customers, works less satisfactory,

Traffic planning aspects

There are rules and routines for monitoring the job of train dispatchers. About once per year, an instructor sits with the individual dispatcher and checks that he is working correctly. The documentation made by the dispatchers is also regularly checked. The safety controller (G) occasionally scrutinizes these checks, and his impression is that they miss quite a lot. These checks are focused on the individual dispatchers and their behaviour.

3.7 Evaluate, enforce and modify rules

General

The blocks 7, 8 and 9 in the framework model are summarised below. In this discussion, these three blocks are discussed together, since quite few answers came on the questions related to these issues.

7) *Evaluate rule effectiveness, errors & violations.* Based on the monitoring of the rules it must be decided whether the rules are appropriate for the given situation and what may need changing. Violations may indicate that other ways of acting are appropriate in some cases.

8) *Enforce use of rules.* If the monitoring and evaluation process shows that the rules are good, but are still violated, enforcement actions must be continued, modified or intensified.

9) *Modify rules.* The rules that the evaluation has shown to need changes must be modified. External changes, such as changes to the law, or to the division of responsibility for given actions may also trigger this rule modification block.

Head office answers

There is rudimentary system for evaluation of rules. It does not work well, and one reason is insufficient feedback between different parts of the organisation.

There is no general answer of how enforcement of rules is made. A general perspective is that the main responsibility for that rules are followed is put on the individual supervisors in the field. A basic attitude is that violations of rules, which are not considered as sabotage, shall not be punished. The reason is that penalties will have negative effects, not least on the reporting of near accidents.

A reason to make changes can be a report about deficiencies in a rule. Reorganisation or changed external demands are other grounds to start a rule change process. There is a general requirement that an evaluation of all rules shall be made every fourth year, but this demand is quite new so there is little experience of it yet.

The routines for changes are considered to work fairly well. One problem is that the process is too sluggish and takes lots of work. Another problem is to get information about problems from other parts of the organisation and from contractors.

In the development and evaluation of rules, there is a procedure with circulation of a proposal for comments. There is a discontent that this is not working so well.

Maintenance aspects

There are a number of problems and violations observed now and then. When enforcement is made, it is as a correction of the affected individuals. There is no tradition of lifting these problems to a higher level in the organisation, in order to get systematic enforcement propose or a rule change.

Two of the interviewees mentioned that they had tried to influence the contents of a rule. One felt that it was too cumbersome and will not try again, while the other was a bit more positive.

Train operating aspects

Each month, the information entered in the reporting system is analyzed. Very seldom there is a need to change rules due to accidents, incidents or deviations. This is explained by fact that the rules have been developed and tried out for a long time.

On the other hand, rules and routines for maintenance of trains are considerably changed by analysis of information in the reporting system.

In the rule example (c) about *Temporary speed reduction*, there is been many comments. And there is now a discussion of an improved version of this rule.

Traffic planning aspects

The monitoring of activities is focused on the individual dispatchers and their behaviour. Occasionally, results are used to improve the behaviour of the local organisation. However, the experiences of the monitoring are not used to improve rules or the general system performance.

If suggestions and ideas for improvements should come up, there is no evident way how suggestions should be forwarded. The only official route would be through the "suggestion box".

4 Analysis and discussion

4.1 About the management of rules

The studied rules

As one example we have used rule (b) *Protection and safety* (BV, 1996), which is in the process of being rewritten. There are different views about the existing rule. Several interviewees have expressed suspicions whether it is useful and if it used. There are obvious many violations of this rule.

The other example was rule (c) *Temporary speed reduction* (BV, 2003). Here there have been complaints about the speedy promulgation, and that the text could easily be misinterpreted.

This highlights also a more general problem with the interpretation of rules, which might have been written from a certain background. For a person with another background, the analysis might be quite different. The tradition of praxis and understanding also has an essential role.

Conflicting needs

There are several stakeholder involved, and the interviews show a number of conflicting needs about the availability of the track. This makes the planning complex and sometimes controversial. This put an extra stress on the safety rules and their interpretation and application.

There are also clear economic components here. It has not been studied in particular, but some aspects have been mentioned here. For example, the safety official making checks of safety work on the track has disappeared, probably of economic reasons.

The application of rules

There appear to be little monitoring of how well rules are followed, especially on maintenance work which we have in focus in this study. Concern has been raised that there are many violations, and that the situation is deteriorating.

In some of the interviews, there has been information that errors and violations exist and sometimes perhaps also are common. When enforcement is made, it is as a correction of the failing individuals, which could be either technicians on the track or train dispatchers. The interviewees meant that there was no system describing how controls should be made. There was neither a guideline for how negative results from controls should be reported and handled in the organisations.

It appeared as the rules, only were intended for persons in the frontline, like maintenance technicians, train drivers, train dispatchers, and their supervisors. This impression comes mainly from the fact that these categories are those trained and tested for rule competence. The supervisors are also addressed as having the main responsibility by the head office.

4.2 About the framework

General

In general, parts of the framework in combination with the guideline for questioning were very useful as a basis for the interview. The number of potential direct questions was high, a few hundreds I guess.

Definition and choice of controls (Block 1 and 2)

There are two starting blocks in the framework: Definition and choice of controls (1 and 2). The questions did not seem relevant to people, and only little information was obtained here.

However, other means of control have been mentioned, but not thought of in relation to rules and the framework. The first is the way agreements are made with contractors for maintenance. There is some kind of business arrangement, which ideally is supposed to take care of safety issues. The impression is that this system has not been very effective in the studied case.

Another example is a more frequent use of automatic train control system, also for temporary speed reduction.

Developing and approving

The blocks 3 and 4 in the model worked fairly well. Although for this basic issue, it was hard to get a deeper discussion and understanding of how it is done. The Swedish tradition is much based on that you circulate a proposal for comments among stakeholders. After a few rounds or meetings, you end up with product that is regarded as sufficiently good.

Promulgate, train, execute

Block 5 worked without problems, and it gave a lot of information.

Monitor use of rules

Block 6 *Monitor use of rule* assumed a certain period of monitoring the rules. In Sweden, there is no such period of monitoring, and you go directly for an implementation. However, we took a broader view and asked about monitoring of new as well as of old rules. Then, there was a lot information obtained, and e.g. a number of violations were reported.

Evaluate, enforce and modify rules

The blocks 7, 8 and 9 in the framework worked fairly well and were easily understood.

Missing parts

The guideline contained four general questions related to the activity of monitoring. There was also a set questions related to maintenance and the scenarios to discuss. The questions were good and well formulated, but they were actually not a part of the monitoring process. My interpretation is that they need to be considered in the framework in another way.

Much of the information obtained did not fit so well the format of the model. In this report, it was solved by putting a number of issues in a chapter with basic information (2.2 – 2.6).

An impression from the discussions during the interviews is that a more holistic perspective could be useful in the model. That a more systemic approach might be valuable in order to discuss the relation between new and old rules, possible conflicts of interest etc.

Possible changes of the framework

Some preliminary ideas after tested the framework are described below. The ideas are only based on my own interviews, and they might be contradicted by other studies.

Block 1 and 2 might be merged to one block, and described more concretely

The Block 6 *Monitor use of rules* can be reformulated and be more general. It can be done by removing the restriction that monitoring should go on for a certain period for a specific rule. One issue is if the block should be concerned only with activity of monitoring, or also address the variety of violations.

The problem with information that did fit in the framework, and the prompts addressed in Block 6 Monitoring, could be solved by inserting another section in the model. It could be called Application of rules and operations, or something like that. One potential feature with such a box could also be to obtain a more holistic perspective.

4.3 About the results

Limitations of result

This study has been of limited size, with less than ten interviews. It is therefore hard to draw any clear conclusions about the general situation in Sweden. The intention has mainly been to test the framework, and the guideline for questions.

Positive aspects

One positive experience from the Swedish case study is the open attitude to discuss how safety issues can be improved. There has been a general interest to discuss such matters in the railway society. Especially, I would like to mention that all persons who were asked for an interview said yes directly and without any hesitation. This openness has revealed several weaknesses in the system. But this should also be seen as strength indicating a good ground for improvements.

Raised questions

However, the results raise a number of potential safety problems, which could be interesting for those responsible for Swedish railway safety. Examples of issues:

- Are the responses obtained in this study generally valid, or has the selection been unfavourable?
- Are there problems with violations of safety rules related to maintenance also on a more general scale?
- Is there an inefficient system for monitoring and evaluation of violations and problems?
- Is the safety system deteriorating or improving? Some indications of new problems have been given.
- How well will the present procedures for rule-writing solve the problems?

5 Conclusions

The model for describing management of safety rules has worked fairly well. However, a few improvements of the model have been suggested.

A number of safety management problems in the Swedish railway system have been indicated. This study has been limited in size, and it is essential to go deeper and check whether these problems are serious and need to be handled in an appropriate way.

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6 References

- BV, Banverket, 1996. BVF 240.100. Skydd och säkerhet vid arbete i spårmiljö
- BV, Banverket, 2001. BVF 900:3. Säkerhetsordning Trafiksäkerhetsföreskrift.
(The latest edition, the original version is several decades old. In the text, we also use the common acronym SÄO.)
- BV, Banverket, 2003. BVF 999.22. Tillfällig hastighetsnedsättning.
Tillägg till BVF 900.3 angående nedsättningar enligt §28:5.
- Hale et al, 2003. A Framework for Safety Rule Management: Work package 2.8 in the SAMRAIL project.