

Review of SPAD-events due to human factors in Norwegian railways in the period 2001 -2005

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- Potentials for serious accidents
- A pattern behind the events can be linked to weekday and month
- The analysis of these patterns should lead to better methods to prevent such SPADs

Introduction

In Norway a register for SPAD-events has been active since 2000, with an average of 400 cases a year. Approximately 85 percent were due to technical errors, and 15 percent to human factors.

In this paper a SPAD is defined as passing a red main signal in regular traffic of all types.

There are approximately..... main signals on the tracks, and Jernbaneverket are the only infrastructure company in Norway, owned by the State.

It is estimated that there are passing's of main signals during a year in Norway.

Methodology

The system for recording all unwanted events, accidents and near accidents was established I 2000. It is commercial electronic data processing system adapted to railway operations. The purpose of the system is to register unwanted events in order to gather enough information to develop better prevention of accidents and SPAD's

For the content in this paper the following methods have been recorded : The driver and the drivers company, the individual main signal that was passed at danger, the weekday and month. This is processed as annual reports, and the sources for this paper have been the five annual reports from 2001 to 2005. In order to give more in dept information on human factors and SPADs, a special study of 29 cases and 51 controls of railway drivers were carried out in 2001-2002.

Findings at group level

1. Occurrence and potential consequences

In Norway approximately 2000 SPAD's were recorded in the five year period 2001 -2005. Out of these around 15 percent were due to human factors. Table 1 shows the different causes to the SPAD's due to human factors. In average there were 53 such events per year in the five year period, and in most instances it is due to actions made by the train driver.

Table 1. Different types of SPAD's caused by human actions. Number and percent. 2000 - 2005. Norway. n=265

Causes	Number and years					2001-2005	
	2001	2002	2003	2004	2005	nos	Percent
Lack of attention from train driver	20	30	23	32	20	125	47,2
Breaking driving rules	5	23	7	4	3	42	15,8
Traffic controller sets signals in "stop"	7	4	15	19	15	60	22,6
Train driver underestimate braking distance	7	2	4	1	9	23	8,7
Misunderstanding. Others	6	2	3	0	7	15	5,7
Average per year	9,0	12,2	10,4	11,2	10,8	53,0	100,0

On important aspect are the anticipated consequences of these type of SPAD. Based on a logic framework with a three level outcome: Grave (head on collision), moderate, low, Table 2 shows the distribution of 157 SPAD's in 2002 -2004.

Table 2. Distribution of outcomes of 157 SPAD's in 2002-2005. Norway. The six grave incidents did not lead to accidents due to ATC.

Year	Number and consequences			
	Grave	Moderate	Low	Total
2002	0	8	40	48
2003	1	6	30	37
2004	4	4	27	35
2005	1	4	32	37
Total and percent	6 (3,8)	22 (14,0)	129 (82,2)	157(100,0)

2. Pattern along a timeframe

The SPAD's have been liked to weekdays and moths, and then two interesting patterns were disclosed, one for weekdays showing a top on Mondays and an undulating pattern with the bottom on Fridays, see Figure 1.

Figure 1. Nos of SPAD's per 10.000 departures distributed on weekdays. 2002- 1.half 2006. Norway. n=157

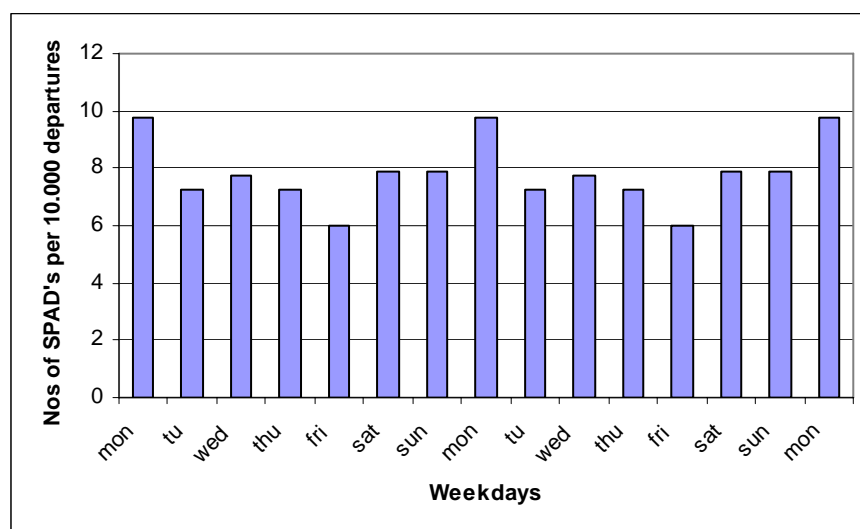
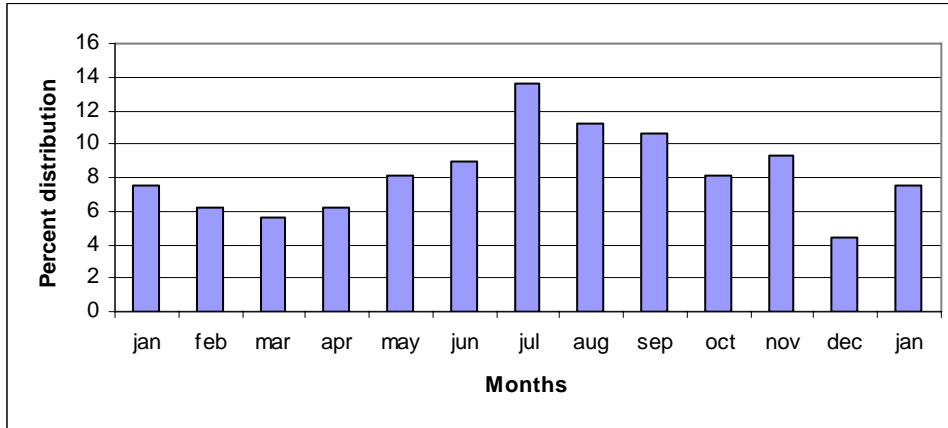


Figure 2 shows the undulation pattern during the year, with the top in the summer months, and the bottom in March and December. There are several explanations to these patterns, which will be discussed in the end of the paper.

Figure 2. Nos of SPAD's per 10.000 departures distributed on months. 2002- 1.half 2006. Norway. n=157



Findings at individual level

the individual level are of two types in this paper: The individual main signal of which there are around 3000 in Norway, and the train drivers with a population of 2500 individuals.

When we examine the individual signals, we find no special which seems to cause more SPAD's, when the frequency of passing's are taken into considerations.

Individual human factors and SPAD's

All of the train drivers and those driving Robels must pass regular medical checks to be allowed to do this type of work. All the train drivers and the newer cadres of Robel drivers have also to pass a psychological test to be accepted for employment. This means that we have a selected group who should have certain level of competence which will prevent SPAD's, at least in theory.

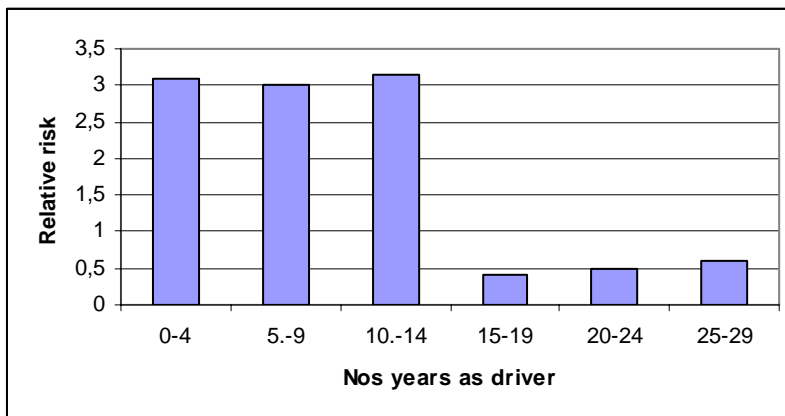
It is therefore interesting to compare a group of "SPAD positive train drivers" with a comparable control group of "SPAD negative". This was done in Norway in 2001-2002, and the material consisted of 29 SPAD positive who were controlled with 51 SPAD negative, that means with same age and years of employment. Among the 29 SPAD positive there were five who had had more than one incident, indicating that there seems to be some "accident prone" train drivers. They are of course a risk group, and there is a need for tools to give a right answer to the question: Should they permanently be taken out of service?

Information from their medical records and their psychological background, there was no difference.

None of the SPAD positive had medical conditions that could explain the incidents.

There was one major difference comparing the SPAD positive with the total population of train drivers, and that is shown in Figure 3. The conclusion is that experience and practice of train driving will decrease the risk for being involved with SPAD, but the required time seem to be more than 10 years. Another contributing factor is the selection-process. Drivers who do not feel comfortable in the job, or do mistakes, will probably leave the company, while the successful stay on.

Figure 3. Relative risk for a train driver to produce a SPAD according to the number of years of service.



Discussion

These data should be discussed from a perspective of how to reduce the number of SPAD's caused by human factors.

First: the number of these types of SPAD's was few, and few of them had serious consequences due to ABS. But still the level of SPAD's should be brought down to zero level.

Could better medical and psychological screening be an answer? According to the low number of SPAD's and the lack of differences in the medical and psychological findings in this material, there seems to be little justification to increase the frequency and content of the professional work at the individual level. But when drivers have more than one SPAD, this should be seen as a signal to do deeper analysis of this small group. Some of them are probably belonging to a risk group, which should be taken out of service.

More important are the findings at group level. Why SPAD are's more frequent on Mondays and in summer? This material does not provide an answer, but knowledge of the lifestyle in Norway and the Nordic countries might give some clues.

One input is to look at the difference between leisure and working time in terms of risk behaviour for being incapacitated after days of no duties. In the Nordic countries the partying and social gatherings mainly take place in weekends and are associated with larger intake of alcohol and other stimulants, resulting in lack of sleep and other unwanted effects on the brain.

Studies have shown that the level of consumption of alcohol has increased substantially in later years, which will have a strong synergetic effect on human risk factors.

The effect of heavier drinking in the weekends and summer days with light and warm evenings could easily have a carry-over from leisure to working hours, given the slow elimination rate of alcohol.

Studies from the workplace in Scandinavia show that 10-15 percent of the employees are heavy drinkers. They have a certain elements of addiction, making them a vulnerable group for having too high level of alcohol in blood when starting to work on Mondays or similar workdays after a leisure period.

An independent factor which can explain the special pattern of SPAD's are the fact that performance of routines deteriorate after a non-work period, compared with performing at a regular and daily basis. This can to a large extent explain the peak of SPAD's during summer when the Nordic people take longer holidays, and to some extent the accumulations of SPAD's after week-ends.

Recommendations

1. Introduction of a systematic and comprehensive program to railway companies with the aim of implementing a “zero alcohol, drug and narcotics programme”. One example is the “Nordic Scoreboard “ which also can measure the present level of commitment.

Measures and activities	Score	Relevance
Adopting a “zero-tolerance” policy	7	Important signal from top management
Implementing the policy in a transparent way. Use of statistics to document the safety and risk levels in annual reports etc.	10	Shows the level of commitment of the company and its practical experiences
Training of the managers in being role-models, and in detection of early stages of addictions among the staff	10	Training of managers. Quality assurance and improved safety standard
Pre-employment medical examination	4	General screening procedure
Pre-employment testing for drugs and illegal substances according to recent standards	6	Specific screening procedure
Regular medical check-ups at age dependent intervals	3	General screening procedure
Questionnaires on drugs and alcohol linked with the medical examinations (AUDIT, CAGE)	5	Specific screening procedure. Obtaining standardised information on drinking habits
Medical examination with relevant biological testing (CDT) on suspicion or referral	10	Important in follow-up of risk groups. Improved verification
Compulsory medical and biological testing of involved personnel after accidents and specified types of near-accidents	10	Will give important information on the role of alcohol, narcotics and drugs as part of the “Human factor” in accident causation and “Incidents” / “Near accidents”
Random testing of at least 25 percent of all employees in safety critical jobs each year	10	Internal control and screening. Random testing is the only method to document and quantify the level of misuse of such substances in safety operations related to “human factor”
Alcohol lock in trains	10	Efficient barrier with direct risk-reduction
Max score	85	Total company score

2. Systematic review of the duties work-schedule for train drivers who has been away for holiday for more than five days. The purpose is to give the brain a briefing of the coming tasks and the risks, specially the first day after holiday. This should work as a “warming up” in the same way as for athletes.

A mini-version should also be given to drivers who start work after long weekends, with a special attention for drivers with less than 10 years of experience.