

## 4 CONCLUSIONS

The conclusions include the causes of the occurrence. A cause means the various factors in the background of the occurrence and the direct and indirect circumstances affecting it.

1. The crew and the driver of the track maintenance machine were from different organisations. They used three languages for communication. There were significant differences between the work experiences of the crew members and the driver.

*Conclusion: Differences in organisational background, experience and age of persons are wont to cause authority problems in the work supervision chain. Additionally, multiple working languages may cause misunderstandings.*

2. The contents of employee introduction were not defined or documented. The work site induction that was the responsibility of the main contractor did not include a review of the traffic safety plan for the work site.

*Conclusion: The lack of a standardised induction system easily causes problems with the comprehensiveness and content of the inductions.*

3. The main contractor's operations had not been audited. An audit of the prime contractor in question had not been scheduled until the autumn of 2017, although deficiencies had been detected in the operations of the contractor, for example in the investigation performed by the Safety Investigation Authority in 2013.

*Conclusion: The Finnish Transport Agency had not audited the contractor despite previously detected deficiencies.*

4. The main contractor did not have its own safety management system for trackwork. In the contract agreement, the contractor had been obligated to improve safety in accordance with the Finnish Transport Agency's safety management system. In practice, implementing a very general-level document, such as the Finnish Transport Agency's safety management system, and putting it into practice in everyday work by each employee is very difficult.

*Conclusion: Adapting the operations of companies to the procedures and requirements of the Finnish Transport Agency's safety management system could best be achieved through contractor-specific safety management systems. In this way, the special characteristics of the companies and work sites could be best taken into consideration.*

5. The unusual location in which the track maintenance machine was left standing was chosen to make work easier, compromising safety. If the traffic safety plan had been followed, the machine could not have been left in the location in question.

*Conclusion: A carefully prepared traffic safety plan plays a key role in ensuring the safety of trackwork.*

6. Monitoring of compliance with the trackwork safety regulations had been outsourced to a single company that had insufficient resources for the job. The monitoring was primarily focused on the progress of the work instead of safety. The monitoring area included the entire Seinäjoki–Oulu track project, and there were several actors to monitor. In practice, on-site monitoring was the responsibility of the contractor's supervisors as self-monitoring. The lack of monitoring resources was already detected during a 2013 investigation by the SIA.

*Conclusion: Track project monitoring resources were insufficient, which had been previously recognised, but no steps had been taken to correct the issue.*

7. When the driver of the machine reported leaving the machine standing, the traffic controller did not question the location, because he had no knowledge of the new turnouts on the trackwork site or their locations. The turnouts were not visible on the centralised traffic control system's display, and he was unfamiliar with the traffic safety plan for the trackwork site. The traffic controller could not form a clear idea of where the maintenance machine had been left standing.

*Conclusion: Traffic control should have access to information that is sufficient for situational awareness.*

8. There are no instructions or regulations concerning where machines may be left standing. For example, the safety instructions for track maintenance (TURO) and the rail traffic and shunting work safety rules (Jt) contain no mentions of the issue.

*Conclusion: A lack of instructions for where machines may be left standing enabled the formation of a dangerous habit.*

9. The machine started rolling downhill after the brake system pressure had decreased so low that the brakes were released. The parking brake was not engaged, and stop blocks were not used.

*Conclusion: In critical phases of work, the distribution of duties and responsibilities, as well as the work methods used, must be precisely defined.*

10. The brake system of the machine was incorrectly adjusted and its linkage was too worn, which had not been detected during the inspections conducted. The movement of the parking brake mechanism to the limit of its motion had not been detected. After the reprofiling of the wheels, the adjustment of the brakes had either not been checked or the brakes had not been adjusted at all.

*Conclusion: The inspections performed on the machine as part of the test drive and transfer permit process were insufficient to guarantee the operation of the machine's brakes.*

11. In order to make work easier, turnout V114 leading to the trackwork site from the direction of Ylivieska had been locked with only a single securing bolt.

*Conclusion: The use of a single securing bolt allowed the machine rolling onto the turnout at a slow speed to force it open. If the turnout had been locked with two securing bolts, it is highly likely that the machine would either have been stopped by the turnout or derailed at the turnout, remaining in the turnout area.*

12. Turnouts V113 and V114 had not been connected to the monitoring of the centralised traffic control. The purpose was to make the changes to the safety devices in one go after the trackwork had been completed.

*Conclusion: The adopted working method where safety device work is done last causes situations where traffic control does not have up-to-date information on track equipment.*

13. The Finnish Transport Safety Agency's approval process for a maintenance machine that was imported as used and is of the same type as machines previously used in Finland concentrated on matters similar to type approval. The inspection of the technical condition of

the individual machine received little attention. Furthermore, the party that conducted the inspections acted in a dual role.

*Conclusion: The operating permit processes of the Finnish Transport Safety Agency mainly concentrate on top-level norms and regulations, leaving issues affecting safety to the background.*