Swiss Transportation Safety Investigation Board STSB
Annual Report 2015


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Swiss Transportation Safety Investigation Board STSB

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Swiss Transportation Safety Investigation Board STSB

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1 Editorial

In 2015, the Swiss Transportation Safety Investigation Board (STSB) made further progress in the direction envisaged and has already been given a new task.

We were able to implement the synergies anticipated as a result of the merger of the former Aircraft Accident Investigation Bureau and the Investigation Bureau for Railway, Funicular and Boat Accidents in various sectors, thereby facilitating the provision of optimised services benefiting the bodies associated with the STSB. Where necessary, the framework conditions have been complemented which enabled us to fix some weaknesses in the organisation through appropriate measures.

The two divisions of the STSB have managed a considerable workload this year. STSB-AV has experienced a busier than average year in terms of accident frequency, and has coped well with its workload despite an unexpectedly difficult situation in terms of resources. The division is also proud to report that it successfully passed an International Civil Aviation Organisation (ICAO) audit in the autumn. Meanwhile, in the Rail/Navigation Division, extensive allocation of resources has been finalised, guaranteeing the consolidation of this division.

At the request of various bodies, in particular the Swiss Maritime Navigation Office and the Federal Department of Foreign Affairs (FDFA), the STSB – already responsible for the investigation of accidents and incidents involving inland navigation – has also been made responsible for respective investigations in maritime navigation. This new remit was also included in the new Ordinance on the Safety Investigation of Transport Incidents in mid-December 2014. One member of staff promptly completed basic training in this area of expertise at a university abroad, and in October 2015 the STSB already had its first assignment in the case of the accident of a ship sailing under the Swiss flag in the North Sea off the Danish coast. The investigation is being carried out in collaboration with specialist services from European maritime

nations and clearly demonstrates the complexity of this new remit. It is important to secure the necessary training and professional development conditions for this challenging field of investigation in the near future.

Despite the challenges in this new area, our main focus of attention remains contributing to the safety of civil aviation and public transport. All this will enable the STSB to continue contributing to increased safety in the future.

André Piller
President of the Board

2 Management Summary

The reporting year was characterised by an above-average number of accidents and serious incidents in civil aviation, whereas there was a below-average number of accidents and hazardous situations in public transport.

The figures are, for the most part, within the normal range of previous years. There are differing trends in civil aviation: for engine-powered lighter aircraft, a decline in safety was observed, whereas the accident numbers involving helicopters and gliders have improved. For federally licensed transport, certain accident categories, such as collisions at unattended railway level crossings, have significantly decreased.

This annual report includes, among other things, a summary of all the safety recommendations issued in 2015 by the STSB. A short introduction and a statement of the reasons why they were addressed to the appropriate supervisory authority have been added. Details on the progress of implementation are also given – where these are already available – for each safety recommendation.

Based on the statistics, the analysis of significant data over a period of several years was continued. It has thereby been possible to determine accident rates involving engine-powered aircraft with a maximum take-off mass of less than 5,700 kg, helicopters and gliders for the years 2007 to 2015, and to define trends. With regards to rail accidents, the development of the absolute number of events in different accident categories was evaluated and trends were derived from this as well. The annual report also explains the methodology of how this analysis was produced.

In 2015, a total of 1,556 notifications concerning accidents and dangerous events were received by the STSB. Analysis of these notifications led to the opening of 63 investigations which will result in a final report. 50 investigations of accidents and serious incidents were concluded and a further 52 clarifications and summary investigations of events of lesser importance were carried out. As part of its investigations, the STSB issued a total of 32 safety recommendations during 2015.

To facilitate readability of the annual report, detailed statistical data and compilations have been provided in the form of annexes.

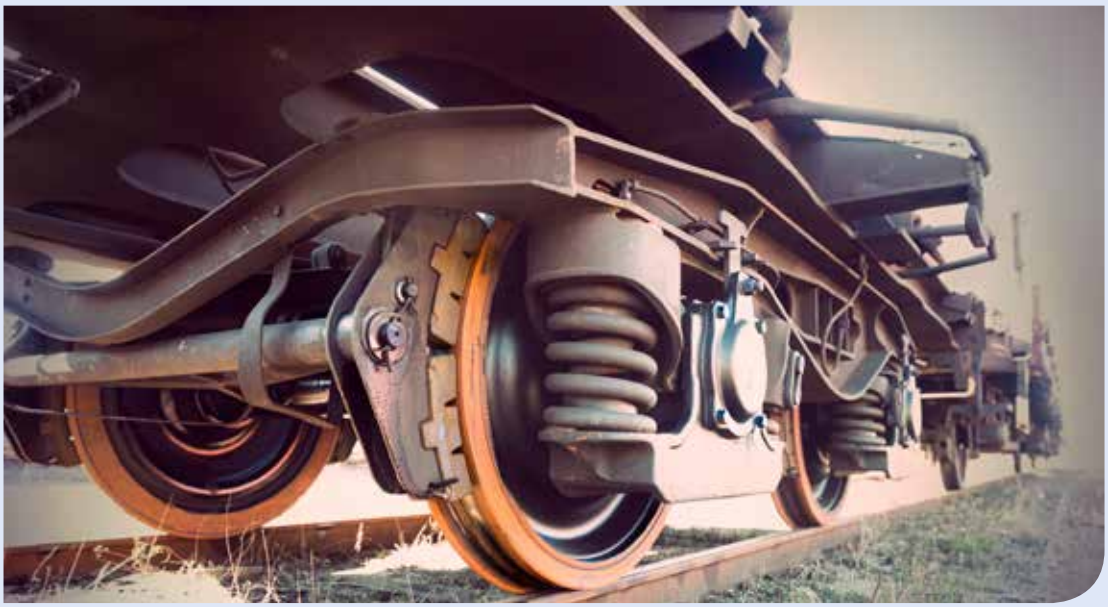
3 Strategy – continuity

After four years working under the current structure, the STSB is a reliable and respected partner in the Swiss national safety system, not least as a result of the high level of specialist expertise in the investigation board's divisions. The generally positive feedback confirms this and the strategy we have adopted. This expertise however must be maintained and further developed at every level.

The extension of the remit in the Ordinance on the Safety Investigation of Transport Incidents (OSITI) to include maritime navigation has started and already had to prove itself in real terms.
Internally, it is important to continue the process of consolidation and, through qualified work, to identify systematic safety deficiencies in particular and to contribute to their elimination.

Externally, relationships must be strengthened with the partners in the Swiss national safety system; however, investigation work must also be coordinated appropriately and professionally with the judiciary, i.e. the Swiss Federal Prosecution Office as well as the cantonal prosecution offices.

4 Board



4.1 Attainment of objectives in 2015

The Board placed the focus for activities in 2015 on consolidation and the use of resources as well as on improvement of the working climate. Vacancies have been successfully filled and some measures arising from the 2014 staff survey have been implemented. An internal newsletter has been created for example, which is published periodically with the aim to provide more direct and timely communication between management and staff as well as between divisions.

The majority of organisational and operating objectives have been attained. For example, central services are in operation cross-divisionally and a substantial part of the investigations has been completed on time.

In terms of human resources, despite temporary vacancies, on-call services were ensured as a key element in the organisation. Systematic recording and management of the training and development measures for employees have been provided. There will be multi-year planning in the coming year.

In the area of quality assurance, the processes for the creation of the product 'final report' have been standardised. The internal audit for the verification of operating procedures will take place in 2016 as the Aviation Division was audited with very good results by the International Civil Aviation Organisation (ICAO).

4.2 Finances

For the reporting year, the Swiss Transportation Safety Investigation Board had a budget of 8.52 million Swiss francs at its disposal. 7.64 million francs were spent. This sum covers STSB's entire personnel and operating expenditure. As is generally customary in other countries as well, the activities of the safety investigation authority are almost exclusively publicly funded and

constitute a service provided by the state to improve transportation safety. All STSB products, in particular the final reports of investigations, are provided free of charge on the internet for example. Printed and bound copies of these reports can be purchased for a fee individually or by subscription if required. The sale of these printed products generated a total of CHF 42,400 in 2015, and represented the STSB's only regular source of income.

4.3 Outlook for 2016

The Board has defined the following key areas for 2016:

Organisation und Betrieb

- Outstanding organisational optimisation is implemented.
- The investigations are completed efficiently and on time and meet the prevention objective effectively and with clear cost transparency.
- To increase safety at work during investigations, including when working abroad, the necessary measures are taken – at least in concept form.
- As a consequence of the forthcoming staffing changes on the Board, all measures are taken to ensure smooth transition to the new management.

Resources

- Existing resources are used in a well-balanced manner in the core area of safety investigation. The on-call service must ensure responsiveness and operational readiness. Within the next two years, the holiday transfers are to be reduced.

Quality assurance, working climate

- The processes for creating final reports are set out so that in a timely manner, high quality is ensured. The internal audit is to evaluate these processes.
- Further measures derived from the findings of the 2014 employee survey are implemented.

5 Investigation Bureau

5.1 Changes / new developments

The reporting year was characterised by the Ordinance on the Safety Investigation of Transport Incidents (OSITI), which came into force on 1 February 2015. The background to this new ordinance is as follows: in 2011, the Aircraft Accident Investigation Bureau (AAIB) and the independent Investigation Bureau for Railway, Funicular and Boat Accidents (IIB) were merged to form the Swiss Transportation Safety Investigation Board (STSB) and the corresponding new Ordinance on the Organisation of the Swiss Transportation Safety Investigation Board (OrgO-STSB) came into force. Concurrent with drawing up the new organisational ordinance, the current ordinances relating to the investigation of aircraft accidents and serious incidents (VFU) and relating to the reporting and investigation of accidents and serious incidents in the operation of public transport (VUU) were also adapted at that time. In the course of this legislative work, however, not all necessary or desired adaptations could be made and not all existing problems could be solved.

In 2013 and 2014, the General Secretariat of the Swiss Federal Department of the Environment, Transport, Energy and Communications, in consultation with the federal departments concerned and the STSB as the main user, unified the existing three ordinances – OrgO-STSB, VFU and VUU – into a single ordinance: the OSITI, and made some modifications to the contents in the process. In the autumn of 2014, a cantonal and official consultation process was carried out. The Federal Council adopted the OSITI on 17 December 2014.

The most important new developments

Where possible and reasonable, in the formal consolidation, the substance of the regulations of the ordinances OO-STSB, VFU and VUU have

been maintained. In particular, the provisions in the ordinances VFU and VUU which regulated the same content have been combined into a single article within the new ordinance.

The new ordinance has, at its beginning, a conventional structure with general provisions and details on the organisation and tasks of the Board. The central elements of notification, investigation and reporting as well as publication are then described chronologically. Provisions on penalties and final provisions conclude the ordinance.

In the course of the legislative work, it quickly became clear that in the various transport sectors, there are peculiarities that cannot be completely standardised. Therefore, the new ordinance still contains sector-specific regulations, in addition to provisions affecting all three transport sectors. These points, which are regulated differently in the transport sectors, are now specified within the same paragraphs or articles.

The former **Swiss Accident Investigation Board**, which legally takes the form of a non-parliamentary commission, was renamed on 1 February 2015 as the **Swiss Transportation Safety Investigation Board** – the German abbreviation SUST (English abbreviation STSB) remains the same. The new name signifies that investigations are exclusively concerned with the safety aspect and that an accident does not necessarily have to have occurred for an investigation to be carried out. Serious incidents in particular also fall within the remit of the STSB. On an international level, the term 'safety investigation' is being increasingly used for this kind of investigation. This is also the case in European legislation which is applicable to Switzerland. At the time of this name change, the names of two internal management bodies were also changed: the former **General Management**, which performs the role of a supervisory committee and consists of the board members elected by the Federal Council, has been renamed the **Board**. The technical secretariat of the STSB, which was formerly referred to as the **Business Office**, is now called the **Investigation Bureau**, reflecting its remit.

The laws on aviation and railways have until now permitted the STSB to impose various forms of compulsory measures. In the past, reference was made multiple times to the fact that the compulsory measures had to be regulated in a concentration of norms, as in the code of criminal procedure. This used not to be the case. This issue has been resolved in the completely revised ordinance (articles 31 to 36). The fact that reference has been made to the code of criminal procedure should however not be misunderstood: the investigations of the STSB are aimed exclusively at improving safety and differ as before from criminal or administrative investigations and are carried out separately from them.

Contrary to the previous ordinances, the new ordinance lays down the criminal liability for failure to notify (article 58). Infringement of the obligation to notify will be subject to punishment with reference to the laws governing railways and aviation.

In Switzerland, (EU) regulation no. 996/2010 has been directly applicable to aviation safety investigations since 1 February 2012. This fact is taken into account in the new ordinance. In the preamble and in article 3, reference is made to this EU regulation; in article 5, differences in the terms used are clarified.

A further new development in the new ordinance is in the expansion of the STSB's remit to incidents occurring in the operation of Swiss maritime navigation. These investigations were, until now, the responsibility of the Swiss Maritime Navigation Office (SMNO), which in turn outsourced this task to a German consultancy company. This company also carries out supervisory tasks for the SMNO. This situation was criticised in an SMNO audit by the International Maritime Organisation (IMO) in 2013. Its stipulation was to separate supervisory and safety investigation tasks and ideally to assign accident investigation to a national authority. As the investigation of incidents in maritime navigation has now been assigned to the STSB, the IMO stipulation has been met.

5.2 Personnel

Aviation Division

One investigator resigned from the AV Division in April 2015, so the number of full-time specialists until the end of the year was four investigators. On recruitment of a new investigator, the number of investigators has been restored to the full complement in the subsequent year.
A new, budget-neutral position for a technical investigator was created and filled in January 2016.
A professional development seminar for full-time and part-time employees was held in December 2015 once more; this covered, among other things, the practical implications of the Ordinance on the Safety Investigation of Transport Incidents (OSITI) introduced in February 2015. The pool of experts, at the end of 2015, comprised a total of 89 part-time investigators available, as needed, to the Aviation Division.

Rail/Navigation Division

In mid-January 2015, the new Head of Division assumed his duties. Together with the team, the processes were evaluated and innovations were then gradually introduced. At the beginning of November, a fifth investigator was appointed, restoring the team of full-time investigators to its full complement.
At the end of 2015, the Rail/Navigation Division therefore had five investigators and 17 part-time investigators.
The focal points of internal and external training and professional development were the acquisition of the necessary procedural knowledge in case of an incident in the Gotthard base tunnel – to be opened in mid-2016 – and with regards to the specific nature of Swiss inland and maritime navigation. At the end of the year, a professional development seminar for all full-time and part-time investigators took place.

Central Services

At the end of 2015, the Head of Central Services retired. This position was filled seamlessly in December 2015 with the recruitment of a new head. One Central Services employee left the Swiss Transportation Safety Investigation Board at the end of August 2015 and her position was filled on the same day. Staff at Central Services carry out cross-divisional tasks at various locations.

5.3 Investigation activities

Aviation Division

A total of 1,260 notifications were received by the Aviation Division in 2015. These events were assessed based on the legislation; whereas, in the case of unintentional air proximity hazards

(airproxes) in particular, additional technical resources were employed to assess the risk.

In the majority of cases, it was possible to play back and analyse data from the flight recorders in the organisation's own laboratory in Payerne. On the basis of these evaluations, 31 investigations of accidents and 16 investigations of serious incidents were opened, including 5 airproxes with a high or considerable risk of collision, and 39 events were summarily investigated. During the same period, 33 investigations were concluded and the corresponding final reports were published (cf. annexe 1). As part of the activities of the Aviation Division, 8 safety recommendations were issued.

In 2015, there was a collision between two ultralight aircraft during an air show in which one pilot lost his life. In the case of a grazing collision between a motorised glider and a light aircraft in the Oensingen region, none of the occupants sustained injuries.

Rail/Navigation Division

In terms of the number of notifications, 2015 was a below-average year. The on-call service received a total of 296 notifications. In 53 cases, the investigator attended the scene. The notifications concerned 232 rail incidents, 19 involving buses, 4 involving boats, 10 involving cable cars and 31 involving trams. A detailed investigation was opened for 87 of the 296 notified incidents, which is an above-average number.

The larger events included: a collision between two passenger trains in Rafz, a collision between two track maintenance trains in Immensee, a collision between two freight trains in Erstfeld, the derailment of a freight train carrying dangerous goods in Daillens, the derailment of a car transporter train in Realp and a run-away train in Baulmes. During this reporting year, one accident occurred at an unattended level crossing. In mid-October, the STSB opened an investigation after a maritime vessel ran aground off the Danish coast.

In the events notified to the STSB, 57 passengers, 31 transport company employees and 108 other individuals suffered injuries in connection with public transport.

During the reporting year, 16 preliminary reports, 2 interim reports, 13 summary reports and 18 final reports were drawn up, sent out and published on the Internet. Overall, 24 safety recommendations were issued.

With regards to the analysis of the causes, it is established that differences between the expected and actual situation, or missing information, are causes of an accident or a serious incident. This is confirmed, in particular, during investigations of shunting accidents. The fact that only one accident took place at an unattended level crossing in the reporting year can be attributed to the effectiveness of the modernisation of level crossings.

6 Safety recommendations

In the first half of the last century, accidents in the transport sector were usually investigated by the individual supervisory authorities. However, since these may be involved in causing an accident or a hazardous situation as a result of their activity, a separation of tasks and powers developed, in particular since the foundation of the International Civil Aviation Organisation (ICAO) in 1944. In most countries, in addition to the supervisory authority, an independent, state safety investigation body also exists, which is expected to clarify impartially the reasons for an accident or a serious incident. Because of the above-mentioned separation of powers, however, the investigation body itself cannot impose measures to improve safety, but can only propose them. To achieve this, the safety investigation authority – in Switzerland the STSB – highlights a possible safety deficit to the competent supervisory authority in an interim or final report and issues corresponding safety recommendations. It is then up to the competent supervisory authority, together with the stakeholders concerned, to decide whether and how the safety recommendations should be implemented.

In 2003, the European Union established the European Aviation Safety Agency (EASA), which shall, on behalf of the member states, provide uniform and binding rules on aviation safety in the European aviation sector. Since that time, EASA has increasingly exercised its authority, particularly in the areas of technology, air traffic, aviation safety and aerodromes. The national supervisory authorities primarily play an executive and mediating role and their exclusive competence is increasingly limited solely to the nationally regulated aspects of civil aviation. Since Switzerland decided to participate in EASA, this change also applies to Swiss civil aviation. For this reason, the Swiss Transportation Safety Investigation Board addresses its Aviation Division safety recommendations, depending on the area of competence, either to EASA or the Federal Office of Civil Aviation.

As (EU) regulation no 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing directive 94/56/EC is also directly applicable in Switzerland since 1 February 2012, the addressees of a safety recommendation are obliged, in accordance with article 18, to confirm receipt of the corresponding transmittal letter to the STSB. They are also obliged, within 90 days of transmission of the safety recommendation, to inform the STSB of the measures taken or considered and, where applicable, of the time required for their implementation or, if no measures are taken, to inform the STSB of the reasons for this.

The operation of railways and inland navigation boats, on the other hand, is primarily regulated nationally. Therefore, under article 48 para. 1 of the Ordinance on the Safety Investigation of Transport Incidents, all Rail and Navigation Division safety recommendations are addressed to the Federal Office of Transport (FOT).

In the following, all safety recommendations issued by the STSB during 2015 as part of interim or final reports are listed. Each individual recommendation is accompanied by a brief description of the respective accident or serious incident, as well as of the safety deficit, which the STSB has established. The implementation status as of 1 March 2016 can be found at the end of each safety recommendation. The current implementation status of safety recommendations and further details can be found on the homepage of the Swiss Transportation Safety Investigation Board.

6.1 Aviation Division

Safety recommendation no. 485, 22/04/2015

After an uneventful landing, a Boeing 737-400 operated by tailwind, registration TC-TLE, was taxiing from runway 34 to taxiway E3 at Zurich Airport. The runways and taxiways were wet and night-time conditions prevailed. The crew received the instruction to taxi to the parking position via taxiways Foxtrot and Charlie. A few metres after passing the turn-off for de-icing lane F2, the pilot turned the aircraft to the right because of a perceived obstruction in order to get to the taxiway south of it via de-icing pad F. The aircraft then came to a standstill on the grass triangle between de-icing lanes F2 and F3 and de-icing pad F, and could no longer move under its own power.

Safety recommendation
The Federal Office of Civil Aviation (FOCA), in cooperation with those responsible for operations at Zurich Airport, should take appropriate measures using clear and consistent instructions and designations to ensure that crews can follow the prescribed taxiways.

Implementation status
Implemented. The sections of taxiway in the area of de-icing pad F have been clearly designated and the signage modified accordingly. Furthermore, technical adjustments have been made in order to be able to individually switch taxiway centre-line lights on and off for de-icing lanes that are not being used. There are also plans to install taxiway edge lights in the areas between taxiways F1, F2 and F3.

Safety recommendation no. 486, 23/02/2015

On returning from a private flight to Geneva, the pilot of a single-engined aircraft informed the air traffic controller of his intention to fly over the concrete runway in order to join grass runway 05 downwind. The air traffic controller's instruction to this aircraft was to fly over the threshold of concrete runway 05 and to call back at the downwind end of grass runway 05. This course, which was not published in the visual approach charts, was justified as a result of the traffic taking off from the airport. The pilot correctly acknowledged the instruction, but continued his flight without changing course, which took him above approach B.

Shortly before flying over the concrete runway, the air traffic controller asked the pilot for his altitude. The latter replied that his altitude was 2,500 ft whereupon the air traffic controller pointed out to him that flying over the

runway should take place at a minimum altitude of 3,000 ft. This restriction, enforced by the ATMM, did not appear on the pilot's documentation. A few seconds later, the air traffic controller gave a type AVRO RJ-100 aircraft permission to take off. Just before rotation, the pilot noticed the Cessna overflying the runway in front of him at an altitude of 2,400 ft, just 1,850 m away.

Safety recommendation
The Federal Office of Civil Aviation should ensure consistency between air traffic control documentation and pilot documentation.

Implementation status
Partially implemented. FOCA has declared that it agrees with the safety recommendation in principle and plans the following two measures in order to implement it: firstly, the visual approach charts will be amended so that the Geneva Airport runway has to be overflown at an altitude of 3,000 feet above mean sea level and secondly, air traffic control is to be requested to demonstrate to FOCA how discrepancies between the underlying documentation are to be avoided in future.

Safety recommendation no. 487, 23/02/2015

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Safety recommendation
The Federal Office of Civil Aviation should assess whether to add speed limits to VFR approaches.

Implementation status
Not implemented. FOCA considers that too much information on the charts affects their legibility. Speed restrictions may be ordered by air traffic control at any time.

Safety recommendation no. 494, 29/06/2015

On 14 June 2012, a Falcon 2000 business aircraft was flying the standard instrument departure route (SID) WIL 1A from Buochs airfield, and climbed to the cleared flight level 100. Approximately three minutes later, the Hawker Hunter HB-RVP received take-off clearance for a flight under visual flight rules from the air traffic controller in the tower at Emmen military airbase. After take-off, HB-RVP continued to accelerate as it climbed on a south-southwesterly course. A short time later, the ATC's short-term conflict alert (STCA) was activated. Shortly after this, the traffic alert and collision avoidance system (TCAS) of the Falcon 2000 issued a traffic warning, followed, seconds later, by an avoidance command, which the crew of the OPJ 700 immediately followed. The two aircraft flew in opposite directions towards one another, crossing about 15 NM south-southeast of the Willisau beacon on flight level 100 at a horizontal distance of 0.9 NM and a vertical distance of 400 ft. At this point the ground speed of the OPJ 700 was 247 kt and that of the HB-RVP 372 kt.

Visual flight conditions prevailed without relevant restrictions caused by clouds or reduced visibility. The crew of the Hunter did not notice the dangerous proximity. The crew of the OPJ 700 were able to visually detect the other aircraft with the assistance of the TCAS shortly before their paths crossed.

The investigation showed that, in addition to other factors, the high airspeed of the civil-registered fighter aircraft had impeded timely warning of both crews, as well as hampering visual search and recognition of the other aircraft.

In this context, it was also reviewed to what extent these or other risks regarding the operation of high-powered aircraft had been established by the operators and the supervisory authorities in the past. In the context of such investigations, the Swiss Transportation Safety Investigation Board reached the conclusion that, with regard to the operation of civil high-performance aircraft, in particular former fighter aircraft, the risks had been – up to then – analysed inadequately, both by the operators and by the supervisory authority. In addition, where risks had been identified, the opportunity was missed to jointly draw up and implement targeted improvements. For these reasons, the Swiss Transportation Safety Investigation Board has identified an urgent need for action, so that in future safer operation of such high-performance aircraft can be ensured.

Safety recommendation
The Federal Office of Civil Aviation (FOCA), in collaboration with the operators of civil high-performance aircraft, especially former fighter aircraft, should lay down basic conditions and operating rules, which on the one hand allow safe operation of these aircraft and on the other hand take into account the safety-related requirements of other airspace users.

Implementation status
Partially implemented. The implementation of this safety recommendation is currently in progress with FOCA. For this reason, it is not possible to communicate any final details here. After the STSB's draft of the final report had been submitted, FOCA imposed adjustments to the Hunter owners' permit to fly. After reading the safety recommendation, FOCA undertook further extensive clarifications together with the stakeholders concerned; among other things, the Hunter operators were audited and, in collaboration with the Swiss Air Force, the facts regarding military air traffic control support were checked. These findings led to a new review of the permit to fly which was issued to the Hunter owners in November 2015 as part of the due legal process. FOCA will probably make a final decision with regards to the measures to be taken before the beginning of the 2016 Hunter flight season.

The Swiss Hunter team and the Altenrhein aviation museum, on their own initiative, have taken many measures to reduce the risks identified.

Safety recommendation no. 495, 10/04/2015

In poor visibility, the flight crew of a Boeing 737-600 made an ILS category I (CAT I) approach at the end of which they momentarily lost control of the aircraft due to inappropriate use of the automatic flight control systems. Spatially disorientated, the pilots made a long landing, touching down hard left of the runway axis. The left main landing gear left the runway for a distance of 120 m and broke two runway lights, debris from which was scattered over the runway. The incident caused an alert to be activated at the control tower, indicating total failure of the runway edge lights. The air traffic controllers were not informed in detail of this malfunction and would not learn until fifty minutes later that three lights were out. As no serious incident was reported, it was not until three hours later during a routine inspection that the lamp debris was discovered on the runway.

Safety recommendation
The Federal Office of Civil Aviation must ensure that the air traffic controllers in the control tower are immediately made aware of any approach light alerts.

Implementation status
Partially implemented. Pending implementation of the safety recommendation, FOCA is requesting that the airport authority orders an immediate inspection of the runway before reopening it to traffic in the event of any defect in runway lighting, particularly when meteorological conditions do not allow visual evaluation from the control tower. Such action both enables inspection of the condition of the runway lighting as well as ensuring that no foreign objects are present on the runway.

Safety recommendation no. 496, 22/04/2015

An aircraft was making a flight under instrument flight rules to Sion airport. The pilot wanted to conduct the final phase of the flight under visual flight rules. A flight plan indicating these intentions was filed.

At the same time, an aircraft operating under instrument flight rules was taking off from Sion airport. The two traffic converged on the same region.

The Geneva air traffic controller decided to let the aircraft heading for Sion enter into class E airspace, located below the controlled class C airspace, which was managed by a different air traffic control unit. In the course of the descent, the instrument rules flight plan was cancelled and the aircraft continued its flight under visual flight rules.

The two aircraft crossed with minimum distances of 2.8 NM laterally and 650 ft vertically in the class C airspace.

At the time of the airprox, the two aircraft were in radio contact with different air traffic control units. Visual contact was not established at any time. Both aircraft were equipped with a TCAS I system. No avoidance manoeuvre was carried out.

There is no defined procedure governing the departure from Sion of IFR traffic conducted simultaneously with VFR traffic destination Sion flying in Swiss class C airspace or class D airspace over French territory.

Safety recommendation
The Federal Office of Civil Aviation should ensure the implementation of a specific procedure for Sion airport governing the departure of an IFR traffic subject to the arrival of a VFR traffic operating within Swiss class C airspace, class D airspace over French territory respectively.

Implementation status
Implemented. In accordance with the measures taken by Skyguide, the coordinator at Sion airfield has had radar

imaging available to him since January 2014. The recommendation is considered to have been implemented, as Skyguide – coordinated with potential IFR take-offs from Sion – has already defined instructions for visual flight rule approaches to Sion.

Safety recommendation no. 500, 01/09/2015

Transmission power and reception sensitivity of Flarm collision warning systems fitted to aircraft cannot be tested on the ground. The reception range of a Flarm system can be easily be checked on the manufacturer's website, because of the data that was recorded in the respective Flarm system. This data can, however, only be registered in flight if the proximity to other aircraft is sufficient.

Safety recommendation
The Federal Office of Civil Aviation (FOCA) should initiate the development of a technical procedure that allows the functionality of Flarm collision alert systems to be assessed on the ground.

Implementation status
Partially implemented. Implementation of this safety recommendation is currently being progressed by FOCA. For this reason, no final details can be communicated here. A functional test of Flarm receivers on the ground is considered to be useful by FOCA, and is also planned for certified systems, so that the interaction of various components can be reliably checked in advance of the flight.

Even if the mode of operation renders this difficult, according to information provided by Flarm Technology, the manufacturer, it should be technically possible to develop a test device that would cost around CHF 2,000. High development costs had been the main reason why no such device had been developed until now.

FOCA has been in contact with the manufacturer, has discussed the possibility of financing through basic research funding and is expecting the manufacturer to make an application in 2016 for the construction of a prototype.

Safety recommendation no. 501, 26/10/2015

On 8 September 2013 at 10:52, the Tecnam P2002-JF aircraft, registered as HB-KPB, took off from grass runway 23 at Geneva Airport. The pilot and one passenger were on board. Approximately thirty seconds later, during the initial climb, the pilot heard a noise resembling an electrical short circuit, immediately followed by the sound of an explosion. Just afterwards, acrid, white, toxic smoke appeared around the feet of the two occupants. The pilot began a right turn, informed the air traffic controller of a problem of smoke in the cockpit and of the fact that he wished to rejoin the grass runway 23 circuit.

Shortly before rejoining the downwind approach, a second explosion occurred in the cockpit and the production of smoke increased significantly. The occupants were no longer able to see the instruments and were concerned by the smoke. HB-KPB was flying a northerly course when the pilot noticed a grassy field and headed towards it. He then asked the passenger to help him open the canopy and the smoke was sucked out of the cockpit. The pilot made an emergency landing outside the airfield.

A defect in the condenser installed in the cabin caused a short circuit, followed by the release of toxic smoke.

Safety recommendation
The European Aviation Safety Agency (EASA) should ensure that the installation of condensers guarantees the safety of occupants in the event of a fault.

Implementation status
Not implemented. EASA responded that the components of the electrical circuit meet the standards in force for this category of aircraft and guarantee the safety of the occupants in the event of a defective condenser. For its part, the manufacturer has decided to reduce the period of use of the condensers. EASA is examining the appropriateness of this measure in consultation with the manufacturer.
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6.2 Rail/Navigation Division

Safety recommendation no. 40, 06.10.2015

DOn Thursday, 2 May 2013, Train 39980 was brought to an emergency stop on the Taverne-Torricella – Mezzovico track by the dispatcher, after the train had gone through a blocked starting signal in Taverne-Torricella. The company ordering the train was different from that supplying the engine driver and shunting loco. The ordering company was unaware that neither the engine driver nor the shunting loco was approved for a train journey.
The inability to distinguish between a shunting movement and a train journey can cause serious accidents.

Safety recommendation
The FOT should examine how simple means can be added to prevent shunting movements on this stretch of track being confused with a train journey.

Implementation status
Implemented.

Safety recommendation no. 41, 06.10.2015

DOn Thursday, 2 May 2013, Train 39980 was brought to an emergency stop on the Taverne-Torricella – Mezzovico track by the dispatcher, after the train had gone through a blocked starting signal in Taverne-Torricella. The company ordering the train was different from that supplying the engine driver and shunting loco. The ordering company was unaware that neither the engine driver nor the shunting loco was approved for a train journey.
Because the shunting locomotive BR 214 belonging to Sersa Group AG was not equipped with a train control system, it was able to drive through stop signals without being halted.

Safety recommendation
The FOT should arrange for the shunting locomotive in question to be fitted with train control.

Implementation status
Not implemented. The FOT is of the opinion that traction units without a train control system appropriate for the trackside assemblies should not be permitted to perform train journeys. This is in the regulations. In its written communication of 4 November 2013 the FOT laid down the minimum equipment for vehicles. Exemption from train control equipment occurs only in justified cases, where it can be shown how adequate safety can be guaranteed. The operator is obliged to carry out a risk assessment related to the particular operation. For these reasons, the FOT will not be implementing the safety recommendation.

Safety recommendation no. 48, 11/06/2015

During construction work carried out by a private company in Kaltbrunn on 9 April 2013, a track-construction excavator accidentally started to roll on a section of sloping track in the Ricken Tunnel. The excavator had a transporter wagon with a ballast wagon attached to the front. At Kaltbrunn station, it collided with a freight wagon, carrying two concrete mixers, parked at the end of the track. The driver of the excavator was able to jump out of the driver's cab just before the collision occurred. The freight wagon was pushed down an embankment as a result of the collision and the excavator derailed. A no longer identifiable technical fault in the control of the hydraulic cylinder of the two-way excavator led to it being lifted from the rail guide axles so that the wheels with tyres were no longer on the rails. It was no longer possible to brake the vehicle using the method selected by the excavator driver.

The investigation of the event has shown that the defective functional safety of rocker control item 70 as well as the accidental actuation of rocker control item 70 and rocker switch item 44 might lead to the same accident recurring.

Safety recommendation
On identical two-way excavators, rocker control item 70 and rocker switch item 44 should be fitted with additional protection to prevent accidental actuation.

Implementation status
To be implemented by the end of 2017.

Safety recommendation no. 49, 11/06/2015

During construction work carried out by a private company in Kaltbrunn on 9 April 2013, a track-construction excavator accidentally started to roll on a section of sloping track in the Ricken Tunnel. The excavator had a transporter wagon with a ballast wagon attached to the front. At Kaltbrunn station, it collided with a freight wagon, carrying two concrete mixers, parked at the end of the track. The driver of the excavator was able to jump out of the driver's cab just before the collision occurred. The freight wagon was pushed down an embankment as a result of the collision and the excavator derailed. A no longer identifiable technical fault in the control of the hydraulic cylinder of the two-way excavator led to it being lifted from the rail guide axles so that the wheels with tyres were no longer on the rails. It was no longer possible to brake the vehicle using the method selected by the excavator driver.

In the event of a technical fault, the wheels with tyres can be lowered by operating the released spring-loaded brakes, which could in turn brake the two-way excavator. This fact is described only in the handbook and not displayed in the driver's cab as is customary. The dependence between these operations and the lifting of the rail guide axles cannot be readily understood.

Safety recommendation
A note should be displayed in the driver's cabin explaining that operation of the parking brake immediately lowers the wheels with tyres.

Implementation status
To be implemented by the end of 2017.

Safety recommendation no. 50, 11/06/2015

During construction work carried out a private company in Kaltbrunn on 9 April 2013, a track-construction excavator accidentally started to roll on a section of sloping track in the Ricken Tunnel. The excavator had a transporter wagon with a ballast wagon attached to the front. At Kaltbrunn station, it collided with a freight wagon, carrying two concrete mixers, parked at the end of the track. The driver of the excavator was able to jump out of the driver's cab just before the collision occurred. The freight wagon was pushed down an embankment as a result of the collision and the excavator derailed. A no longer identifiable technical fault in the control of the hydraulic cylinder of the two-way excavator led to it being lifted from the rail guide axles so that the wheels with tyres were no longer on the rails. It was no longer possible to brake the vehicle using the method selected by the excavator driver.

Safety recommendation
In the driver's cab of the two-way excavator, a table should be displayed with the permitted unbraked and braked trailer loads and the relevant inclines.

Implementation status
To be implemented by the end of 2017.

Safety recommendation no. 51, 11.06.2015

On Tuesday 18 September 2012, two passengers had an accident on the Pontresina – Alp Languard chairlift in Pontresina. During the ascent, chair no. 37 carrying two passengers slipped downhill on the haul rope, colliding with the following chair no. 38, which was also occupied by two passengers. The passengers on chair no. 38 were injured by the impact. The passengers in chair no. 37 remained uninjured.
The clamp of vehicle no. 37 slipped on the haul rope, because the clamps had not been tightened in accordance with the operating instructions. Work on safety components had not been carried out strictly in line with the operating instructions.

Safety recommendation
All work carried out on safety components must be in accordance with the operating instructions. Where the operating instructions are unclear, the transport company should clarify them with the manufacturer.

Implementation status
Implemented.

Safety recommendation no. 52, 11.06.2015

On Tuesday 18 September 2012, two passengers had an accident on the Pontresina – Alp Languard chairlift in Pontresina. During the ascent, chair no. 37 carrying two passengers slipped downhill on the haul rope, colliding with the following chair no. 38, which was also occupied by two passengers. The passengers on chair no. 38 were injured by the impact. The passengers in chair no. 37 remained uninjured.
The clamp of vehicle no. 37 slipped on the haul rope, because the clamps had not been tightened in accordance with the operating instructions. Work on safety components had not been carried out consistently in line with the two-man rule.

Safety recommendation
Work carried out on safety components must apply the two-man rule.
Work must be documented and confirmed by the signature of those involved.

Implementation status
Implemented.

Safety recommendation no. 53, 11.06.2015

On Tuesday 18 September 2012, two passengers had an accident on the Pontresina – Alp Languard chairlift in Pontresina. During the ascent, chair no. 37 carrying two passengers slipped downhill on the haul rope, colliding with the following chair no. 38, which was also occupied by two passengers. The passengers on chair no. 38 were injured by the impact. The passengers in chair no. 37 remained uninjured.
The clamp of vehicle no. 37 slipped on the haul rope, because the clamps had not been tightened in accordance with the operating instructions. The measuring device used to check the pull-off force of the clamp was not specifically designed for the grip in question.

Safety recommendation
The pull-off force of the clamp should be measured using an appropriate device that connects to the clamp in the rope plane.

Implementation status
Implemented.

Safety recommendation no. 54, 11.06.2015

On Tuesday 18 September 2012, two passengers had an accident on the Pontresina – Alp Languard chairlift in Pontresina. During the ascent, chair no. 37 carrying two passengers slipped downhill on the haul rope, colliding with the following chair no. 38, which was also occupied by two passengers. The passengers on chair no. 38 were injured by the impact. The passengers in chair no. 37 remained uninjured.
The clamp of vehicle no. 37 slipped on the haul rope, because the clamps had not been tightened in accordance with the operating instructions. The slipping rope clamp of no. 37 may have damaged the haul rope.

Safety recommendation
The positions of clamps no. 37 and no. 38 before the incident should be permanently marked on the haul rope. This area of the haul rope should be inspected visually for external damage at the regular resetting of the clamps. In addition, clamps should no longer be affixed to this stretch of the haul rope. At the next magneto-inductive rope testing, the rope testing centre must be informed of the incident.

Implementation status
Implemented.

Safety recommendation no. 55, 11.06.2015

On Tuesday 18 September 2012, two passengers had an accident on the Pontresina – Alp Languard chairlift in Pontresina. During the ascent, chair no. 37 carrying two passengers slipped downhill on the haul rope, colliding with the following chair no. 38, which was also occupied by two passengers. The passengers on chair no. 38 were injured by the impact. The passengers in chair no. 37 remained uninjured.
The clamp of vehicle no. 37 slipped on the haul rope, because the clamps had not been tightened in accordance with the operating instructions. The push rod, an element of the safety component of clamp No. 37, did not conform to the manufacturer's specifications for size. The cableway company was not aware of this fact.

Safety recommendation
The push rods should be examined for dimensional accuracy. In particular, the dimensions and are directly relevant to safety and must be adhered to. Push rods that do not conform to these dimensions must be replaced.

Implementation status
Implemented.

Safety recommendation no. 67, 25.08.2015

On Thursday 10 January 2013 at 07:34, the S11 train No. 19126 from Schaffhausen collided at entry point 25 in Neuhausen with the S33, train No. 20330, travelling from Winterthur to Schaffhausen. The collision caused injury to 17 persons and substantial material damage. The distance between the exit signal and the danger spot was too short to bring a normally accelerating train to a standstill before the point of collision. Neuhausen did not have a departure hindrance system.

Safety recommendation
The FOT should arrange for stations with the same or similar operating conditions to be equipped with departure hindrance function.

Implementation status
Will be implemented.

Safety recommendation no. 68, 18/03/2015

On Wednesday 12 June 2013, at around 00:46, during maintenance work on the overhead line, two employees came into contact with the line in Wila, while it was live. One employee was severely injured and the other suffered minor injuries. The supervisor had given his staff permission over the phone to set the locking key for the lifting platform and to commence work. The locking keys are always in the control panel of the lifting platform and are freely accessible.
As the locking key is freely accessible in the lifting platform, it can be lifted into the danger area of a live overhead line at any time and without technical dependence on the status of the overhead line.

Safety recommendation
When working at heights, technical dependence should be created in lifting platforms by not making a locking key for lifting the platform available until an earthing rod on the wagon is attached to the overhead line.

Implementation status
Awaiting response.

Safety recommendation no. 69, 18/03/2015

On Wednesday 12 June 2013, at around 00:46, during maintenance work on the overhead line, two employees came into contact with the line in Wila, while it was still live. One employee was severely injured and the other suffered minor injuries. The supervisor had given his staff permission

over the phone to set the locking key for the lifting platform and to commence work. There are a number of stipulations, rules and instructions concerning working on electrical systems. To know their contents and to apply them at all times places considerable demand on the employees. If these documents expire without being replaced, this renders safe working even more difficult. Sometimes, work has to be carried out using regulations that are no longer in force.

Safety recommendation
Volume 178, 'Instructions for drivers of lifting platform wagons' from regulation R 402.4, 'Regulation on the training of drivers of small engines and road vehicles' should be reviewed and republished.

Implementation status
Implemented.

Safety recommendation no. 70, 18/03/2015

On Thursday 19 September 2013 at approx. 13:15, at Glovelier railway station, the Chemins de Fer du Jura train no. 245 collided with the stop buffer at the end of the track on platform 13. The buffer was moved by about ten metres and a contact line mast was torn up. The front bogie of carriage no. 632 was derailed. No one was injured. On entering the railway station, the train driver had momentarily lost concentration and had not activated the brakes after the initial reduction in speed.

If an individual exercising an activity crucial to safety experiences health problems and starts taking regular medication, that person must inform the medical advisor who is required to make a ruling on continuation of the aforementioned activities.

The Ordinance on Activities Crucial to Safety in the Railways Sector (OASF) does not provide the medical advisor with the option of issuing a notice of temporary incapacity to drive trains whilst the train driver is receiving medical treatment that may influence his ability to concentrate.

Safety recommendation
SESA recommends that OFT should adapt the Ordinance on Activities Crucial to Safety in the Railways Sector (OASF) in order to state in it that when an individual suffering from an illness is receiving medical treatment that is incompatible with the exercising of a safety function, that individual must immediately inform the medical advisor. The latter must rule whether temporary incapacity to drive trains during the period when he is under medication must be declared.

Stage of implementation
Partially realised. The FOT considers the safety recommendation to have been implemented with Art. 12 paras. 1 and 2 and Art. 13 of the Ordinance on Railway Safety Activities (RSAO). This assessment of the Approvals and Rules Section was also supported by the FOT's Medical and Legal Services in the Statement on the final report.
Regarding the explicit duty to provide the medical officer with details of regular medication taken, the FOT presented arguments against referring hereby to the RSOA. Apart from the incident in Glovelier, no other incidents are known to the FOT in which taking medicine had been involved as a cause. The FOT is therefore of the opinion that this is not a relevant risk that would justify a specific mention in the regulations.

The STSB continues to hold the opinion that there is no directive obliging staff to consult the medical officer if medication is being taken over a longer period; the medical officer would then, if necessary, judge whether the employee was temporarily incapacitated to drive locomotives.

Safety recommendation no. 71, 18/03/2015

On Thursday 19 September 2013 at approx. 13:15, at Glovelier railway station, the Chemins de Fer du Jura train no. 245 collided with the buffer at the end of the track on platform 13. The buffer stop was moved by about ten metres and a contact line mast was torn up. The front bogie of carriage no. 632 was derailed. No one was injured. On entering the railway station, the train driver had momentarily lost concentration and had not activated the brakes after the initial reduction in speed.

If an individual exercising an activity crucial to safety experiences health problems and starts taking regular medication, that person must inform the medical advisor who is required to make a ruling on continuation of the aforementioned activities.
Due to the current organisation of the medical system (no single contact), information on the state of health of an individual carrying out an activity crucial to rail safety is distributed between several colleagues. There is therefore a latent risk that information is not properly circulated between all medical colleagues.

Safety recommendation
SESA recommends that OFT should adapt the Ordinance on Activities Crucial to Safety in the Railways Sector (OASF) so that medical data gathered on individuals covered by the aforementioned ordinance further to various stipulated examinations should be centralised with the medical advisor who signed the most recent medical fitness examination.

Stage of implementation
Not implemented. The FOT supports the view that the RailO and its implementing provisions on the equipment of vehicles applies. The FOT agrees that vehicles performing train journeys must have train control systems. This is not absolutely necessary for shunting manoeuvres. It is for the vehicle operator to ensure that vehicles are appropriately equipped for their particular use.

Safety recommendation no. 76, 18/03/2015

On Monday 16 June 2014, engine Tm III no. 98 85 0232 530-7 belonging to the Widmer Rail Services (WRS) company should have been routed from Renens towards Bussigny station, in order to then arrive at the Scheuchzer company's spur track. The vehicle was undertaking a 'main line manoeuvre' between these two stations while a line block was in operation.

While the Renens rail traffic controller was concluding the procedure as defined by the checklist, the train driver started moving the engine as soon as dwarf signal 149A on platform 7 of Renens station opened, without awaiting the compulsory approval to move in this kind of situation.

Once the manoeuvre had arrived at Bussigny station, the Bussigny rail traffic controller contacted the train driver to obtain an explanation. After the conversation, the train driver asked him what part of the station he should travel to, in order to reach the Scheuchzer spur line.

A motorised vehicle without any train operation control system, circulating under its own power on a line equipped with an operational line block is a hazard, as it is not able to interpret the information transmitted by the infrastructure safety system and because the vehicle cannot, under certain circumstances, be automatically immobilised when a signal showing the 'stop' image is crossed. A single error can counteract all the company's efforts to increase safety.

Safety recommendation
Taking into account its operating concept, engine Tm III no. 98 85 0232 530-7 should be equipped with a train operation control system.

Stage of implementation
Not implemented. The FOT supports the view that the RailO and its implementing provisions on the equipment of vehicles applies. The FOT agrees that vehicles performing train journeys must have train control systems. This is not absolutely necessary for shunting manoeuvres. It is for the vehicle operator to ensure that vehicles are appropriately equipped for their particular use.

Safety recommendation no. 77, 18.03.2015

On Monday 16 June 2014, shunting tractor Tm III belonging to Widmer Rail Services was due to be shunted from Renens station towards Bussigny station and then transferred onto the Scheuchzer siding. The vehicle was operating as a "shunting movement onto open track" between two stations, and the line block system was functioning normally. Once the dispatcher had ended the process as required by the checklist, the engine driver set the tractor in motion, as soon as dwarf signal 149A on track 7 of Renens station indicated clear, without awaiting confirmation from the dispatcher, which is compulsory in such a situation. After arrival of the shunting movement in Bussigny station, the dispatcher in Bussigny contacted the engine driver to ask for an explanation. At the end of the conversation the engine driver asked the dispatcher in which direction he should drive in order to reach Scheuchzer's siding. Deployment on track or in stations with which a driver is not familiar contains a certain risk of errors.

Safety recommendation
The transport company's safety management system should be adapted to include the risk control process and the determination of staff skills.

Implementation status
Implemented.

Safety recommendation no. 78, 18.03.2015

On Monday 16 June 2014, shunting tractor Tm III belonging to Widmer Rail Services was due to be shunted from Renens station towards Bussigny station and then transferred onto the Scheuchzer siding. The vehicle was operating as a "shunting movement onto open track" between two stations, and the line block system was functioning normally. Once the dispatcher had ended the process as required by the checklist, the engine driver set the tractor in motion, as soon as dwarf signal 149A on track 7 of Renens station indicated clear, without awaiting confirmation from the dispatcher, which is compulsory in such a situation. After arrival of the shunting movement in Bussigny station, the dispatcher in Bussigny contacted the engine driver to ask for an explanation. At the end of the conversation the engine driver asked the dispatcher in which direction he should drive in order to reach Scheuchzer's siding. When ordering a shunting movement onto open track, there is

no check on which undertaking has issued the order. This means nobody has checked whether the staff have the necessary skills, or whether the vehicles used are approved for these transport services.

Safety recommendation
Shunting movements on open track should be allocated using a Debicode to an RU that possesses a network access operating licence.

Implementation status
Will be implemented by analogy. The FOT explains that the safety recommendation indicates an ambiguity in the allocation of RU responsibility in shunting movements. The FOT will analyse the safety relevance of this allocation and if necessary develop appropriate solutions together with the ISB and RU as part of the further development of the Richtlinie zum Erlangen von Netzzugangsbewilligung und Sicherheitsbescheinigung sowie Sicherheitsgenehmigung [Directive on obtaining a network access licence and safety certificate, and safety approval, in German]. The safety target will be implemented by analogy.

Safety recommendation no. 82, 25.08.2015

On Monday 1 July 2014 at 13:38, a cyclist collided with Regionalzug Aigle-Champéry provided by the Transport Publics du Chablais (TPC) on the level crossing by the Monthey-Ville station. The level crossing was signalled by a St Andrew's cross. The cyclist suffered fatal injuries.
In emergency situations, not using rapid brake application may extend the braking distance. Full brake application does not affect all the vehicle's braking systems (e.g. magnetic brake) and is not recorded.

Safety recommendation
The STSB recommends that the FOT ensure engine drivers are reminded to use rapid brake application rather than full brake application in emergency situations.

Implementation status
Awaiting response.

Safety recommendation no. 85, 12/05/2015

On Sunday 21 July 2013, at around 03:53, a wagon derailed during a shunting movement at Schaffhausen station. Only material damage occurred.

Under normal circumstances, a shunting route is set by a signal box in one step from destination to starting point. In the case of the 'Siemens SpDrS-SBB' type signal box with type X3 modules, as used in Schaffhausen, the system makes it possible for the route to be only partially set. This may result in derailments, in particular in the case of short stretches of track between individual dwarf signals. Signal box installations of the same type are present at Schaffhausen, Bussigny, Bern, Zurich North, Lausanne Triage, Chiasso Smistamento and Basel RB East. These installations are of differing design, because they are fitted with ILTIS, have few shunting movements or are topographically different. In the case of Bern, the system is to be replaced by 2019.

Safety recommendation
Given that some routes cannot be set completely and in these cases clearance is given for partial routes, the Federal Transport Office should examine whether the risk of derailment or collision is acceptable for the operational use of the seven SpDrS-SBB systems.

Implementation status
Awaiting response.

Safety recommendation no. 86, 10/11/2015

On Saturday 25 April 2015 at around 02:49, the last five wagons of freight train no. 60700 linking Basel to Lausanne Triage were derailed on an open stretch of track at the 19.0-kilometre mark located in the municipality of Daillens. The train consisted of 22 wagons, 14 of which contained hazardous substances.

A few hundred metres before the location where the derailed wagons came to a halt, the 20th wagon lost some of the components of the running gear from one of its bogies. When passing a track-side device situated just before a right-hand bend, the wagon derailed, drifted onto the left-hand side of the track causing, by dynamic effect, the preceding two wagons to tip over, the following wagon to tip over and the first bogie of the last wagon of the train to derail.

Wagons 18 to 21, all containing chemical products, overturned onto their sides. When the wagons were overturned, the tank on wagon no. 19 – containing 25 tonnes of sulphuric acid – was damaged, allowing its contents to escape onto the ground beside the track. Pushed by the two wagons behind it, wagon no. 20 rotated 180° on its longitudinal axis, i.e. rotated round on itself, before tipping over onto the side of the track. Its tank had been damaged, allowing approximately 3,000 litres of caustic soda to escape.

Findings made during the inquiry concerning axle boxes 1 to 4 of the 20th wagon indicated the likelihood of a quality issue in the assembly of the axle boxes. The inspection carried out on 28 October 2015 in the maintenance workshop revealed deficiencies in the assembly quality of the axle boxes.

The presence of solid foreign objects (of mineral origin or residues of metallic particles) in the axle box bearing lubricant can block the bearings then give rise to rapid overheating which can cause damage to the bearing. A blocked axle bearing can result in the derailing of a wagon.

The presence of cleaning fluid in the bearings of an axle box does not present an immediate risk of bearing blockage, but degrades the quality of the lubricant. Degraded lubricant can, over the course of time, cause overheating of the bearing and therefore, gradually cause damage to the bearing before its next service interval has elapsed.

Safety recommendation

SESE recommends that OFT should, through the certification body, take immediate corrective action regarding the process of mounting axle box bearings in the ECM accredited maintenance workshop.

Implementation status

Implemented.

Safety recommendation no. 87, 10/11/2015

On Saturday 25 April 2015 at around 02:49, the last five wagons of freight train no. 60700 linking Basel to Lausanne Triage derailed on an open stretch of track at the 19.0-kilometre mark located in the municipality of Daillens. The train consisted of 22 wagons, 14 of which contained hazardous substances.

A few hundred metres before the location where the derailed wagons came to a halt, the 20th wagon lost some of the components of the running gear from one of its bogies. When passing a track-side device situated just before a right-hand bend, the wagon derailed, drifted onto the left-hand side of the track causing, by dynamic effect, the preceding two wagons to tip over, the following wagon to tip over and the first bogie of the last wagon of the train to derail.

Wagons 18 to 21, all containing chemical products, overturned onto their sides. When the wagons were overturned, the tank on wagon no. 19 – containing 25 tonnes of sulphuric acid – was damaged, allowing its contents to escape onto the ground beside the track. Pushed by the two wagons behind it, wagon no. 20 rotated 180° on its longitudinal axis, i.e. rotated round on itself, before tipping over onto the side of the track. Its tank had been damaged, allowing approximately 3,000 litres of caustic soda to escape.

Findings made during the inquiry concerning axle boxes 1 to 4 of the 20th wagon indicated the likelihood of a quality issue in the assembly of the axle boxes. The inspection carried out on 28 October 2015 in the maintenance workshop revealed deficiencies in the assembly quality of the axle boxes.

The presence of solid foreign objects (of mineral origin or residues of metallic particles) in the axle box bearing lubricant can block the bearings then give rise to rapid overheating which can cause damage to the bearing. A blocked axle bearing can result in the derailing of a wagon.
The presence of cleaning fluid in the bearings of an axle box does not present an immediate risk of bearing blockage, but degrades the quality of the lubricant. Degraded lubricant can, over the course of time, cause overheating of the bearing and therefore, gradually, cause damage to the bearing before its next service interval has elapsed.
Quality deficiencies in the axle boxes noted during the inspection on 28 October 2015 may affect a considerable number of axle boxes currently in service and constitute a latent safety deficit.

Safety recommendation

SESE recommends that OFT, through the certification body, should undertake immediate corrective measures regarding the process of mounting axle box bearings in the ECM accredited maintenance workshop.

Implementation status

Implemented.

Safety recommendation no. 88, 10/11/2015

On Friday 2 October 2015, at around 08:20, service train 8008 consisting of control carriage BDt no. 53 at the head and self-propelled engine Be 4/4 n°2 at the rear, ran away just after Sainte Croix at 21,300 km, on a line with a gradient of up to 44 ‰, derailing on open track on a left-hand bend at 17,900 km between the Trois-Villes and Six-Fontaines stops.

As part of the inquiry, anomalies relating to safety were found in the area of the brakes on type Be 4/4 self-propelled engines and type Bt and BDt control carriages. Such carriages are in operation both with the Transports Vallée de Joux, Yverdon-les-Bains, Sainte Croix SA (TRAVYS) company and the Transport Morges-Bière-Cossonay (MBC) company. Drainage of the supply duct during emergency braking triggered by a safety device prevents compressed-air recharging throughout the train. The engine's whistle then becomes immediately unusable. The design of type Be 4/4 engines manufactured by TRAVYS and MBC with the assembly of electrovalve A14 at the exit of the main reservoirs represents a major safety deficit.

Safety recommendation
SESE recommends that OFT should adapt the pneumatic installation of the TRAVYS and MBC engines concerned in order to ensure at all times the recharging of the carriage's supply duct – in the event of triggering caused by one or other of the safety systems – by replacing the A14 solenoid valve with BV solenoid valves. SESE recommends that OFT adapts the pneumatic system of the TRAVYS and MBC motor carriages concerned in order to ensure at all times the recharging of the carriage's supply duct in the event of actuation caused by one or other safety system, by replacing the A14 electrovalve with BV electrovalves.

Implementation status
Implemented.

Safety recommendation no. 89, 10/11/2015

On Friday 2 October 2015, at around 08:20, service train 8008 consisting of control carriage BDt no. 53 at the head and self-propelled engine Be 4/4 No. 2 at the rear, ran away just after Sainte Croix at 21,300 km, on a line with a gradient of up to 44 ‰, derailing on open track on a left-hand bend at 17,900 km between the Trois-Villes and Six-Fontaines stops.

As part of the inquiry, anomalies relating to safety were found in the area of the brakes on type Be 4/4 self-propelled engines and type Bt and BDt control carriages. Such carriages are in operation both with the Transports Vallée de Joux, Yverdon-les-Bains, Sainte Croix SA (TRAVYS) company and the Transport Morges-Bière-Cossonay (MBC) company.

Safety recommendation
On a steeply inclined line, complete inertia braking weight of the train obtained by the braking systems independent of the air brake must be ensured. An incorrect indication of the independent braking weight values of the air brake on a wagon may lead to dangerous operating conditions and constitutes a safety deficit. The immobilisation braking weight value of 2 t of control car no. 51 referred to in the TRAVYS DE-PCT is incorrect.

Implementation status
Implemented.

7 Analysis

7.1 Analysis of the statistical data of the Aviation Division

As for the previous years' annual reports, the statistical data for the past seven years has also been analysed for this annual report. Subsequently, statements concerning the development of aviation safety in Switzerland could be derived.

Measured variable, methods and comparisons

In its accident statistics, the Aviation Division does not compare absolute but rather relative accident figures, so-called accident rates. This means it was looked at how many accidents have occurred per 1 million air traffic movements. Accident rates always refer to a specific year and a specific category of aircraft.

In the accident statistics, a distinction is made between the following aircraft categories:

- Motorised aircraft with a maximum take-off mass of up to 5,700 kg;
- Gliders, including motor gliders and touring motor gliders;
- Helicopters.

For an event in aviation to be classified as an accident, the event must be known to the STSB and meet the criteria for an accident, and at least one person must have been seriously or fatally injured.

In order to make a statement about whether a value is within or outside a range regarded as normal, the multiple of the estimated standard deviation σ was calculated for each annual event rate. In the standard normal distribution, the range between -1 σ and +1 σ is considered to be the normal range of variation. Values lower than -1 σ are considered to be an improvement in safety; values greater than +1 σ are considered to be deterioration in safety.

In addition, as in the 2014 annual report, it has been calculated whether the events of the three categories have generally increased or decreased over the last seven years (the trend). The criterion for this was the gradient of the straight line of a simple linear regression applied to the absolute accident figures. A positive gradient means deterioration in safety; a negative gradient means an improvement in safety.

Caution must be exercised when further interpreting the statistics. There is a danger of making invalid statements. As air traffic movements are partially collected in different ways, it is problematic, for example, to compare the safety of the three aircraft categories that were analysed on the basis of the data in the following graph. For the same reason, caution is also recommended when comparing figures from abroad. Definitions and delimitations may be different in other countries.

Details on the applied measured value, the statistical method and an estimation of errors are given in section 7.1 of the 2013 annual report.

Statements concerning aviation safety

In summary, it can be stated that 2015 stands out for some significantly diverging trends in the various sectors of Swiss civil aviation. On the one hand, there seems to be an improving trend in flight safety in the glider and helicopter sectors, whereas the current data seems to indicate that safety in the motorised aircraft sector is deteriorating.

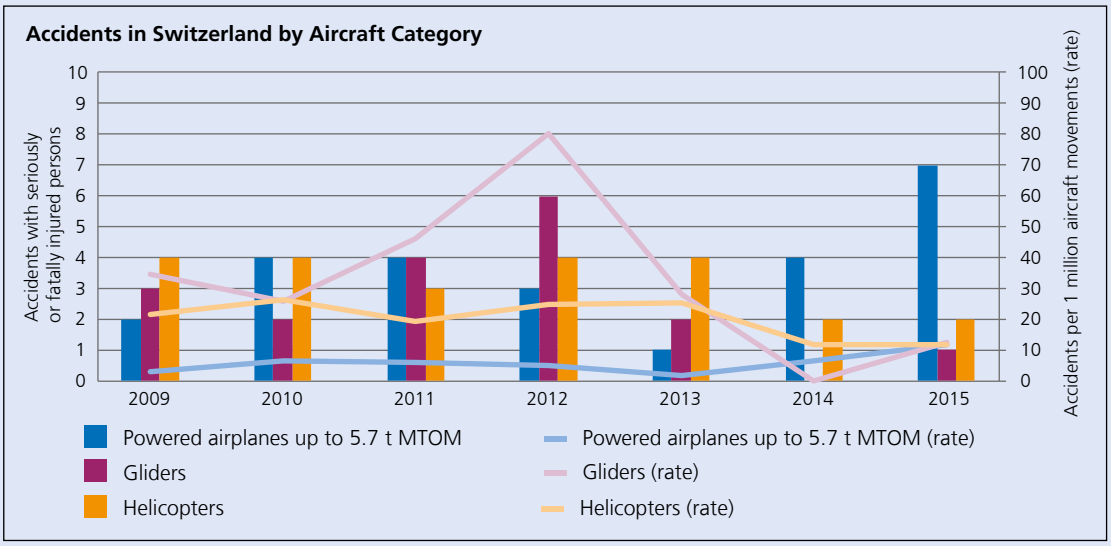
An analysis of the accident statistics, using the methods and criteria described above, produces the following results:

- For motorised aircraft with a maximum take-off weight up to 5,700 kg, the accident rate was approximately 12 accidents per one million air traffic movements; in absolute terms, seven accidents. This corresponds to approximately +1.9 σ in the standard normal distribution and is therefore within the range of unusually high accident rates. The trend is positive (+0.4 accidents per year). Since systematic data collection began in 2007, a higher accident rate or a higher absolute number of accidents has never been recorded for this category.
- For gliders, the accident rate was approximately 13 accidents per one million air traffic movements. This corresponds to approximately -0.8 σ in the standard normal distribution and is therefore within the normal range for the years 2009 to 2015. The trend is negative (-0.4 accidents per year).
- For helicopters, the accident rate was approximately 12 accidents per one million air traffic movements. This corresponds to approximately -1.3 σ in the standard normal distribution and is therefore within the range of unusually low accident rates. The trend is negative (-0.3 accidents per year).

If the unusually high accident rate for motorised aircraft is not actually due to chance, we can assume deterioration in safety for this aircraft category. The clear positive trend for motorised aircraft seems to confirm such deterioration in safety for this aircraft category.

The reasons for potential improvements or deteriorations in safety in the various sectors of Swiss civil aviation cannot, however, be derived from this statistical data.

The following graph shows the absolute numbers of accidents and the accident rates for the three aircraft categories that were analysed in the years 2009 to 2015.



Absolute numbers of accidents and the accident rates for the three aircraft categories in the years 2009 to 2015.

7.2 Analysis of the statistical data of the Rail/ Navigation Division

As for the previous years' annual reports, the statistical data for the past seven years has also been analysed for this annual report. Subsequently, statements on the development of the operational safety of rail, trams and buses could be derived.

Measured variable, methods and comparisons

A distinction was made between the following categories of events in the event statistics:

- Collisions at attended level crossings
- Collisions at unattended level crossings
- Other collisions (including trams)
- Derailments (including trams)
- Rail carriage[1] fires
- Bus fires

All notified events were included in the event statistics regardless of whether the event met the criteria of an accident and regardless of whether an investigation was actually opened.

In order to make a statement about whether a data value is located within or outside a normal range, the multiple of the estimated standard deviation σ was calculated for each annual events rate. In the standard normal distribution, the range between -1 σ and +1 σ is considered as the normal range. Values lower than -1 σ are considered to be an improvement in safety; values greater than +1 σ are considered to be a deterioration in safety. Further details on the statistical method are given in section 7.2 of the 2013 annual report.

[1] In the annual reports for the previous years, the event category "fires" covered those events in/on rail carriages, buses, cable cars and boats. In this annual report, fires in cable cars and on boats are no longer taken into account. Apart from that, the fires in rail carriages and buses are listed now in separate categories. The figures for 2009 to 2014 have now been included in the same way.

In addition, as in the 2014 annual report, it has been calculated whether the events of the categories have generally increased or decreased over the last seven years (the trend). The criterion was the gradient of the straight line of a simple linear regression applied to the absolute figures. A positive gradient means a deterioration in safety; a negative gradient means an improvement in safety.

Because the obligation to notify, the reporting culture and definitions, delimitations and conditions for including an event in the statistics are subject to different regulations in some cases; caution is required when making comparisons with figures of other organisations or countries. This applies in particular to the safety statistics of the Federal Office of Transport and the Federal Statistical Office. There is a risk of making invalid statements.

Statements concerning the safety of railways, buses and cable cars

An analysis of the event statistics, using the methods described above, produces the following results:

- There were 12 collisions at attended level crossings. This corresponds to approximately -0.8 σ in the standard normal distribution and is therefore within the normal range for the years 2009 to 2015. The trend is negative (-1.5 events per year).
- There was 1 collision at an unattended level crossing. This corresponds to approximately -1.8 σ in the standard normal distribution and is therefore within the range of unusually low accident rates. The trend is negative (-0.1 events per year).
- There were 34 other collisions (including trams). This corresponds to approximately -0.4 σ in the standard normal distribution and is therefore within the normal range of variation for the years 2009 to 2015. The trend is positive (+2.6 events per year).
- 38 derailments (including trams) were recorded. This corresponds to approximately +0.8 σ in the standard normal distribution and is therefore within the normal range for the years 2009 to 2015. The trend is positive (+0.6 events per year).
- There were 3 rail carriage fires. This corresponds to approximately -1.3 σ in the standard normal distribution and is therefore within the range of unusually low accident rates. The trend is negative (-0.4 events per year).
- 9 bus fires were reported. This corresponds to approximately +1.2 σ in the standard normal distribution and is therefore within the range of unusually high accident rates. The trend is positive (+0.8 events per year)

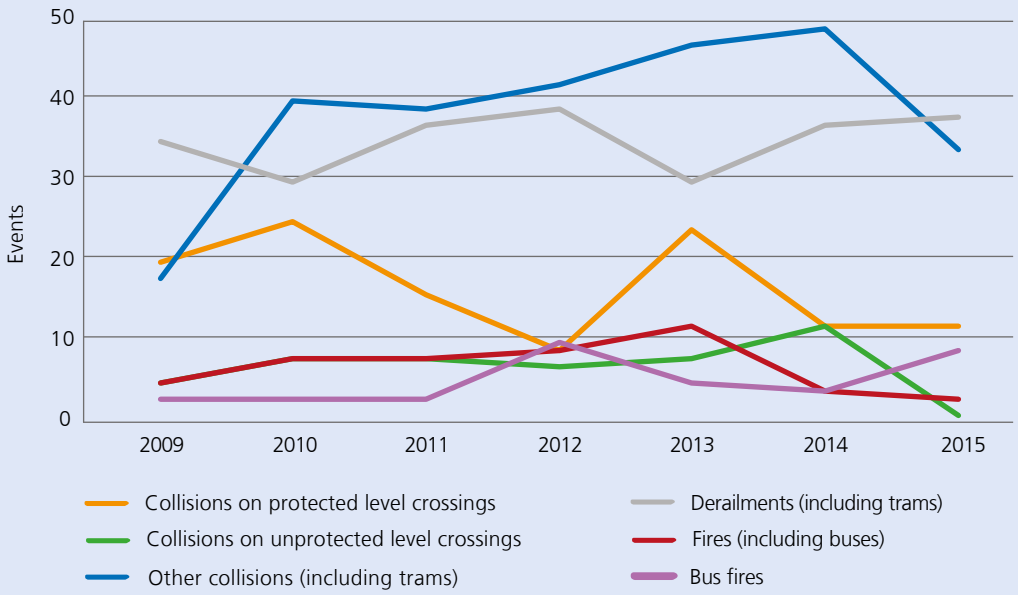
On the basis of these findings, the STSB states that overall, 2015 was an average year in terms of safety for the operation of railways, buses and cable cars in Switzerland.

The event categories "collisions at unattended level crossings" and "other collisions" both reached their highest values in 2014 and the trend in both categories was rising too. This problematic development was slowed down in 2015. Increased attention should however continue to be paid to the trend in the "other collisions" category of events with, on average, 2.6 additional events per year.

While the category of "rail carriage fires" has fortunately recorded few events, the trend in bus fires should be seen as problematic.

The following graph shows the numbers of events for the six event categories that were analysed for the years 2009 to 2015.

Events in Switzerland Reported to STSB, by Event Category



Annexe

Annexe 1: List of final reports published by the Swiss Transportation Safety Investigation Board Aviation Division in 2015

Annexe 2: List of final reports published by the Swiss Transportation Safety Investigation Board Rail/Navigation Division in 2015

Annexe 3: Statistical data, Aviation Division

Annexe 4: Statistical data, Rail/Navigation Division

Annexe 1

List of final reports published by the Swiss Transportation Safety Investigation Board Aviation Division in 2015

Number	Code	Date	Location	Safety recommen-dations
2201	HB-SCL	25.06.2008	Waltenschwil/AG	–
2206	HB-5522	26.07.2012	Romont/FR	–
2210	HB-CPL	26.04.2013	Bex/VD	–
2215	TC-TLE	11.10.2013	Zurich	485
2216	Airprox SWR119D/SWR18	22.03.2013	Zurich	–
2217	Airprox HB-CKH/SWR49A	31.08.2013	Geneva	486, 487
2226	Airprox HB-RVP/OPJ700	14.06.2012	Zurich	494
2227	Airprox HB-LBU/HB-FKC	03.03.2013	Zurich	–
2228	TS-IOL	24.11.2012	Geneva	495
2229	Airprox D-IKSI/N600HS	22.03.2013	Sion/VS	496
2230	HB-ZHZ	24.01.2014	Lauterbrunnen/BE	–
2231	HB-5506	04.09.2013	Laax/GR	–
2232	HB-IPX	11.12.2012	Stockholm (Sweden)	–
2233	Airprox HB-ZBB/HB-ZRY	21.06.2013	Klöntalersee/GL	–
2234	Airprox MLT251/HB-2377	21.06.2013	Bern	–
2235	Airprox HB-VPF/HB-1589	13.07.2013	Bern	–
2236	N400AJ	12.06.2012	Zurich	–
2237	D-HMGD/HB-ZJE	27.04.2013	Grenchen/SO	–
2239	HB-ZDI	06.07.2013	Altishofen/LU	–
2240	HB-JVH	15.07.2013	Zurich	–
2241	HB-1620	27.09.2014	Olten/SO	–
2242	Summarische Berichte 2014			–
2243	Airprox HB-2461/HB-3097	16.06.2014	St. Moritz/GR	500
2245	9A-CQC	27.09.2013	Zurich	476, 477
2246	HB-IOR	01.10.2013	Porto (Portugal)	–
2247	HB-3410	03.08.2013	Sarnen/OW	–
2249	HB-ZIX	26.09.2013	Schwyz/SZ	–
2250	HB-PNR	23.07.2013	Sarnen/OW	–
2251	HB-PDC	27.08.2013	Sarnen/OW	–
2252	HB-KPB	08.09.2013	Prévessin (France)	501
2256	HB-IOP	06.10.2014	Basel	–
2257	HB-IJU	12.09.2013	FIR Marseille (France)	–
2259	HB-WYC	26.05.2014	Lommis/TG	–

Annexe 2

List of final reports published by the Swiss Transportation Safety Investigation Board Rail/Navigation Division in 2015

Number	Operation category	Type of accident	Date	Location	Safety recommendations
12091803	Cable car	Cable car event	18.09.2012	Pontresina	51, 52, 53, 54, 55
2013011002	Rail	Collision of two passenger trains	10.01.2013	Neuhausen	67
2013030801	Rail	Derailment	08.03.2013	Cossonay	–
2013040901	Rail	Collision with obstacle	09.04.2013	Kaltbrunn	48, 49, 50
2013050201	Rail	Irregularity without immediate danger	02.05.2013	Mezzovico	40, 41
2013061201	Rail	High-voltage accident	12.06.2013	Wila	68, 69
2013061902	Rail	Derailment of two freight wagons	19.06.2013	Basel Kleinhüningen	–
2013071301	Rail	Collision of a train and a tilting rail crane	13.07.2013	Zurich Oerlikon	–
2013072101	Rail	Shunting accident	21.07.2013	Schaffhausen	85
2013091801	Rail	Derailment of a shunting movement	18.09.2013	Zurich Vorbahnhof	–
2013091901	Rail	Collision of a train and a buffer	19.09.2013	Glovelier	70, 71
2014013001	Rail	High-voltage accident	30.01.2014	Fribourg	–
2014030901	Rail	Collision of a train and an obstacle	09.03.2014	Grauholz	–
2014061601	Rail	Irregularity without immediate danger	16.06.2014	Bussigny	76, 77, 78
2014070101	Rail	Collision of a train and a cyclist	01.07.2014	Monthey	82
2014071501	Rail	Collision at an attended level crossing	15.07.2014	Beinwil am See	–
2014072203	Rail	Accident involving people at railway station	22.07.2014	Roggwil-Wynau	–
2014101202	Rail	Derailment of a shunting movement	12.10.2014	Gurtnellen	–

Annexe 3

Statistical data Aviation Division

Contents

1. Preliminary remarks

The purpose of an air accident investigation is to create the basis for the avoidance of future similar accidents and serious incidents by clarification of the circumstances and causes.

The legal appraisal of accidents is not the subject of investigation and final reporting.

The following annual statistics contain all accidents and serious incidents investigated involving civil-registered Swiss aircraft in Switzerland and abroad and involving foreign-registered aircraft in Switzerland.

Accidents involving parachuters, hang gliders, kites, paragliders, tethered balloons, unmanned balloons and model aircraft are not subject to investigation.

2. Definitions

Some significant terms used in air accident investigation are explained below:

Accident

An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

a) a person is fatally or seriously injured as a result of:
   - being in the aircraft, or
   - direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
   - direct exposure to jet blast,

   except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) the aircraft sustains damage or structural failure which adversely affects the structural strength, performance or flight characteristics of the aircraft, and would normally require major repair or replacement of the affected component, except for engine failure or damage when the damage is limited to a single engine (including its cowlings or accessories), to propellers, wingtips, antennas, probes, vanes, tyres, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or minor damage to the main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome); or

c) the aircraft is missing or is completely inaccessible.

Serious injury
An injury which is sustained by a person in an accident and which involves one of the following:

a) hospitalisation for more than 48 hours, commencing within seven days from the date the injury was received;
b) a fracture of any bone (except simple fractures of fingers, toes, or nose);
c) lacerations which cause severe haemorrhage, nerve, muscle or tendon damage;
d) injury to any internal organ;
e) second- or third-degree burns or any burns affecting more than 5% of the body surface;
f) verified exposure to infectious substances or harmful radiation.

Fatal injury
An injury which is sustained by a person in an accident and which results in his or her death within 30 days of the date of the accident;

Large aeroplane
An aeroplane which has a maximum takeoff mass (MTOM) of at least 5,700 kg, is classified in airworthiness category Standard, subcategory transport or has more than ten seats for passengers and crew.

Country of Registration
Country where the aircraft is registered with the national aviation authority.

Country of Manufacture
The country or countries that have certified the airworthiness of the prototype (type).

Country of the operator
Country in which the operator's principal place of business or permanent residence is located.

3. Tables and graphs

3.1 Aircraft accidents and serious incidents involving Swiss-registered aircraft, inventory of the aircraft and list the deceased

Year	Number of registered aircraft [1]	Flight hours [1]	Flight personnel Licences [1]	Number of accidents investigated	Number of accidents with summary investigations	Total number of accidents	Number of serious incidents (incl. Airprox)	Airprox investigated [2]	Total number of accidents and serious incidents	Number of deceased
2004	3893	749 535	16 382	29	34	63	10	14	73	14
2005	3841	768 643	15 501	22	37	59	12	9	71	15
2006	3822	715 572	15 368	27	31	58	10	7	68	10
2007	3813	766 557	15 076	23	20	43	4	6	47	12
2008	3765	784 548	14 691	28	19	47	5	6	52	11
2009	3685	842 017	14 973	26	17	43	4	3	47	5
2010	3705	793 592	15 313	21	16	37	8	4	45	8
2011	3709	873 548	12 855 [3]	21	24	46	13	8	59	13
2012	3657	875 708	12 840	22	20	42	23	10	65	22
2013	3620	933 752	11 871	28	16	44	20	11	64	15
2014	3556	919 987	11 563	18	28	46	13	5	59	8
2015	**3494**	**865 404**	**11 536**	**29**	**24**	**53**	**22**	**4**	**75**	**12**

[1] Reference: Federal Office of Civil Aviation (FOCA)

[2] Incl. Airprox involving foreign-registered aircraft

[3] Based on the Air Navigation Act, no more student pilot licences are issued since 01.04.2011

3.1.1 Aircraft accidents and serious incidents involving Swiss-registered aircraft with MTOM over 5700 kg

Year	Number of registered aircraft[1)]	Flight hours[1)]	Number of accidents investigated	Number of accidents with summary investigations	Total number of accidents	Number of serious incidents (incl. Airprox)	Airprox investigated[2)]	Total number of accidents and serious incidents	Number of deceased
2004	248	435 820	1	0	1	10	14	11	0
2005	241	445 228	0	0	0	12	9	12	0
2006	248	434 050	1	0	1	8	7	9	0
2007	260	393 368	3	0	3	0	5	3	1
2008	285	385 686	1	0	1	3	5	4	0
2009	293	394 055	0	0	0	4	3	4	0
2010	303	419 323	0	0	0	6	3	6	0
2011	299	458 225	0	0	0	9	8	9	0
2012	294	475 786	0	0	0	11	7	11	0
2013	290	540 826	1	0	1	11	8	12	0
2014	284	483 673	1	0	1	7	3	8	0
2015	**284**	**466 086**	**1**	**0**	**1**	**11**	**1**	**12**	**0**

[1)] Reference: Federal Office of Civil Aviation (FOCA)

[2)] Incl. Airprox involving foreign-registered aircraft

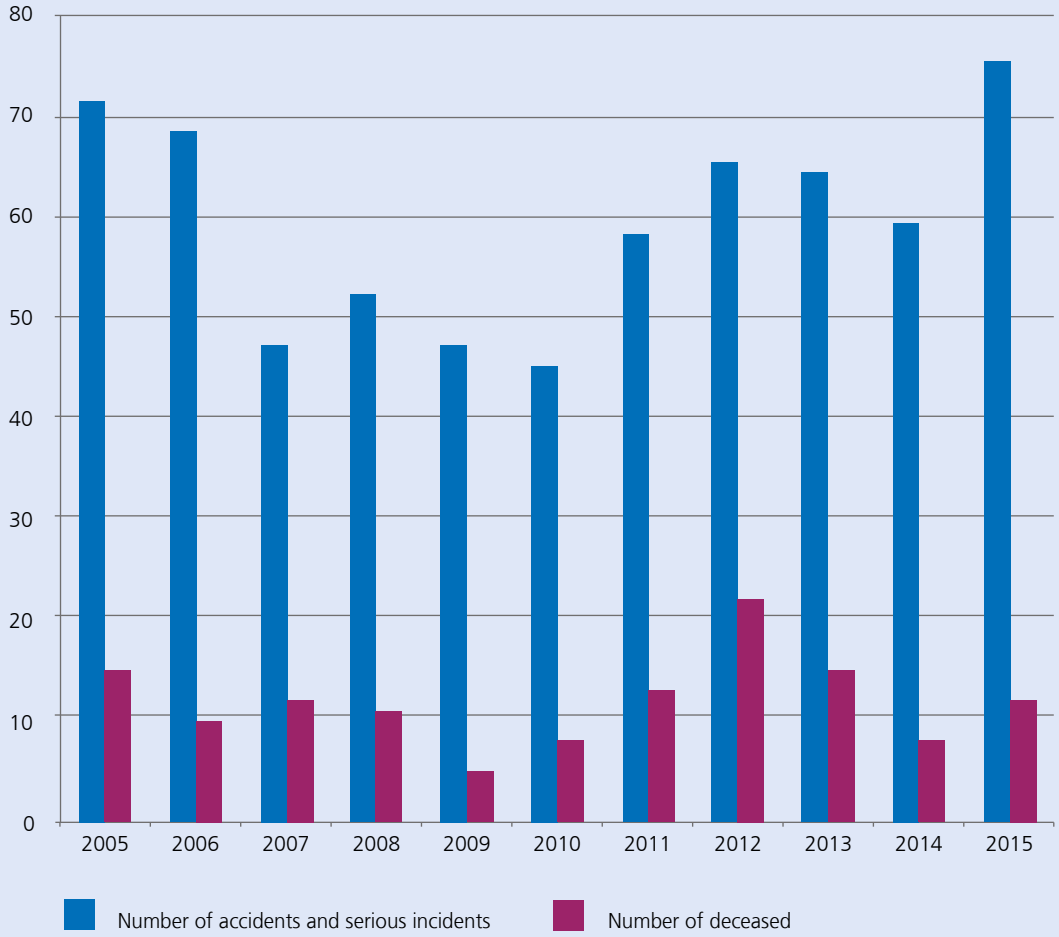
3.1.2 Aircraft accidents and serious incidents involving Swiss-registered aircraft with MTOM up to 5700 kg

Year	Number of registered aircraft[1)]	Flight hours[1)]	Number of accidents investigated	Number of accidents with summary investigations	Total number of accidents	Number of serious incidents (incl. Airprox)	Airprox investigated[2)]	Total number of accidents and serious incidents	Number of deceased
2004	3645	313 715	28	34	62	0	0	62	14
2005	3600	323 415	22	37	59	0	0	59	15
2006	3574	281 522	26	31	57	2	0	59	10
2007	3553	373 189	20	20	40	4	1	44	11
2008	3480	398 862	27	19	46	2	1	48	11
2009	3392	447 962	26	17	43	0	0	43	5
2010	3402	374 269	21	16	37	2	1	39	8
2011	3410	415 323	22	24	46	3	0	49	13
2012	3363	399 922	22	20	42	12	3	54	22
2013	3330	392 926	27	16	43	9	3	52	15
2014	3272	436 314	17	28	45	6	2	51	8
2015	**3210**	**399 318**	**28**	**24**	**52**	**11**	**3**	**63**	**12**

[1)] Reference: Federal Office of Civil Aviation (FOCA)

[2)] Incl. Airprox involving foreign-registered aircraft

3.1.3 Graphical overview of accidents and serious incidents involving Swiss-registered aircraft, inventory of the aircraft and list the deceased



3.2 Accident data and persons involved in accidents – reporting period 2014 / 2015

3.2.1 Accidents and serious incidents involving Swiss-registered aircraft in Switzerland and abroad, and foreign-registered aircraft in Switzerland according to their category, including and excluding injuries to persons

	Accidents and serious incidents involving Swiss-registered aircraft						Accidents and serious incidents involving Swiss-registered aircraft						Accidents and serious incidents involving foreign-registered aircraft					
	in Switzerland						abroad						in Switzerland					
	Total		Persons injured		Persons not injured		Total		Persons injured		Persons not injured		Total		Persons injured		Persons not injured	
	2015	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014
Total	**64**	53	**8**	7	**56**	46	**11**	6	**3**	3	**8**	3	**10**	11	**2**	0	**8**	11
Aircraft with MTOM up to 2250 kg	**37**	30	**5**	4	**32**	26	**4**	2	**1**	1	**3**	1	**5**	6	**2**	0	**3**	6
Aircraft with MTOM 2250–5700 kg	**0**	1	**0**	0	**0**	1	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Aircraft with MTOM over 5700 kg	**7**	6	**0**	0	**7**	0	**5**	2	**0**	0	**5**	2	**5**	5	**0**	0	**5**	5
Helicopter	**12**	10	**2**	2	**10**	8	**0**	1	**0**	1	**0**	0	**0**	0	**0**	0	**0**	0
Motor gliders and gliders	**7**	5	**1**	0	**6**	5	**2**	1	**2**	1	**0**	0	**0**	0	**0**	0	**0**	0
Balloons and airships	**1**	1	**0**	1	**1**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0

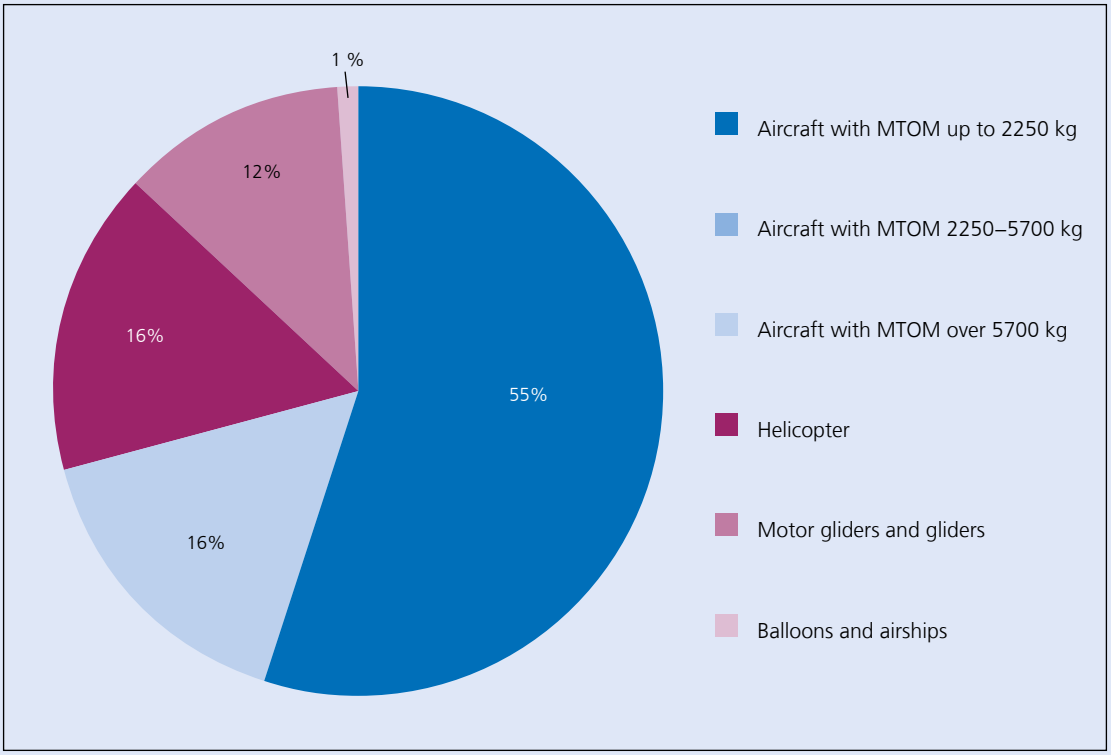
3.2.2 Aircraft inventory and accidents / serious incidents involving Swiss-registered aircraft

	Number of registered aircraft [1] (01.01.2015)		Total number of accidents / serious incidents	
	2015	2014	**2015**	2014
Aircraft with MTOM up to 2250 kg	**1397**	1425	**41**	32
Aircraft with MTOM 2250–5700 kg	**169**	171	**0**	1
Aircraft with MTOM over 5700 kg	**284**	284	**12**	8
Helicopter	**326**	321	**12**	11
Motor gliders and gliders	**949**	978	**9**	6
Balloons and airships	**369**	377	**1**	1
Total	**3494**	3556	**75**	59

[1] Reference: Federal Office of Civil Aviation (FOCA)

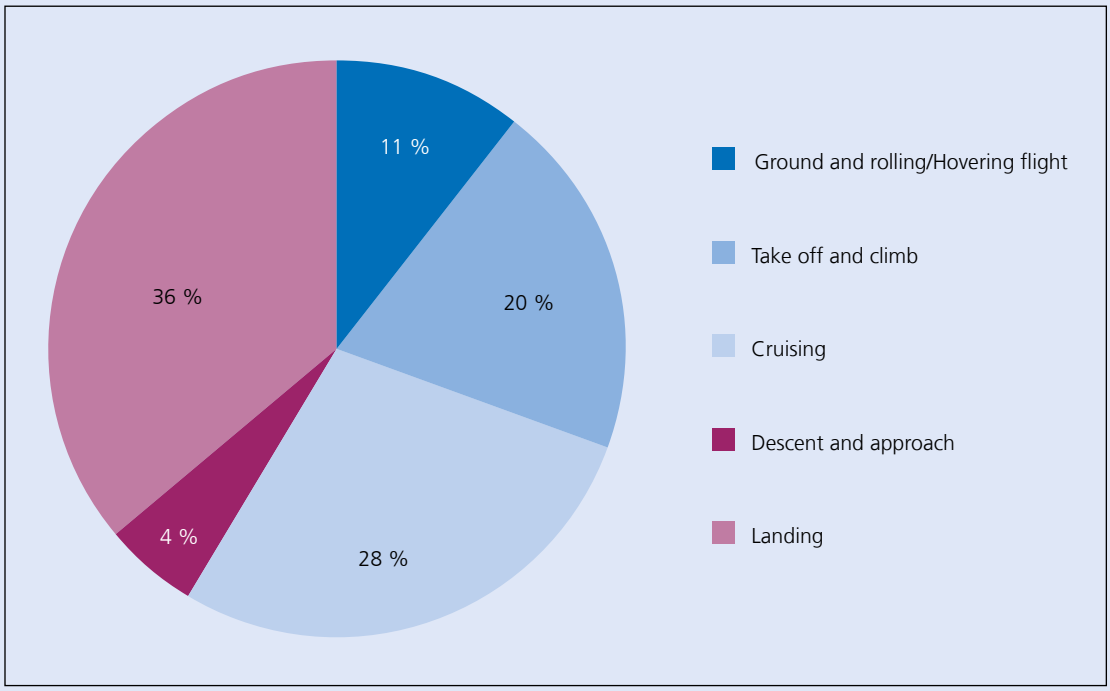
3.2.3 Accidents and serious incidents involving Swiss-registered aircraft according to category of aircraft

	2015	2014
Aircraft with MTOM up to 2250 kg	**55 %**	54 %
Aircraft with MTOM 2250–5700 kg	**0 %**	2 %
Aircraft with MTOM over 5700 kg	**16 %**	13 %
Helicopter	**16 %**	19 %
Motor gliders and gliders	**12 %**	10 %
Balloons and airships	**1 %**	2 %



3.2.4 Flight phase (accidents and serious incidents involving Swiss-registered aircraft in Switzerland and abroad, and foreign-registered aircraft in Switzerland)

	Ground and rolling/ Hovering flight		Starting and climb		Cruising		Descent and approach		Landing		Total	
	2015	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014
Aircraft with MTOM up to 2250 kg	**6**	5	**8**	10	**8**	2	**1**	2	**18**	19	**41**	38
Aircraft with MTOM 2250–5700 kg	**0**	1	**0**	0	**0**	0	**0**	0	**0**	0	**0**	1
Aircraft with MTOM over 5700 kg	**2**	0	**1**	3	**7**	3	**1**	3	**1**	4	**12**	13
Helicopter	**0**	1	**3**	2	**2**	3	**2**	3	**5**	2	**12**	11
Motor gliders and gliders	**0**	0	**3**	3	**4**	2	**0**	0	**2**	1	**9**	6
Balloons and airships	**0**	0	**0**	0	**0**	0	**0**	0	**1**	1	**1**	1
Total	**8**	7	**15**	18	**21**	10	**4**	8	**27**	27	**75**	70



3.2.5 Persons involved in accidents according to their function for accidents and serious incidents involving Swiss-registered aircraft in Switzerland and abroad, and foreign-registered aircraft in Switzerland

	Accidents and serious incidents involving Swiss-registered aircraft in Switzerland													
	Total		Aircraft with MTOM up to 2250 kg		Aircraft with MTOM 2250–5700 kg		Aircraft with MTOM over 5700 kg		Helicopter		Motor gliders and gliders		Balloons and airships	
	2015	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014
Accidents/ Serious incidents	**64**	53	**37**	30	**0**	1	**7**	6	**12**	10	**7**	5	**1**	1
Deceased	**7**	2	**5**	2	**0**	0	**0**	0	**1**	0	**1**	0	**0**	0
Crew	**6**	1	**4**	1	**0**	0	**0**	0	**1**	0	**1**	0	**0**	0
Passengers	**1**	1	**1**	1	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Persons seriously injured	**7**	10	**4**	7	**0**	0	**0**	0	**3**	2	**0**	0	**0**	1
Crew	**4**	4	**2**	3	**0**	0	**0**	0	**2**	1	**0**	0	**0**	0
Passengers	**3**	5	**2**	4	**0**	0	**0**	0	**1**	0	**0**	0	**0**	1
Third persons	**0**	1	**0**	0	**0**	0	**0**	0	**0**	1	**0**	0	**0**	0

	Accidents and serious incidents involving Swiss-registered aircraft abroad													
	Total		Aircraft with MTOM up to 2250 kg		Aircraft with MTOM 2250–5700 kg		Aircraft with MTOM over 5700 kg		Helicopter		Motor gliders and gliders		Balloons and airships	
	2015	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014
Accidents/ Serious incidents	**11**	6	**4**	2	**0**	0	**5**	2	**0**	1	**2**	1	**0**	0
Deceased	**5**	6	**2**	0	**0**	0	**0**	0	**0**	5	**3**	1	**0**	0
Crew	**4**	2	**1**	0	**0**	0	**0**	0	**0**	1	**3**	1	**0**	0
Passengers	**1**	4	**1**	0	**0**	0	**0**	0	**0**	4	**0**	0	**0**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Persons seriously injured	**0**	4	**0**	2	**0**	0	**0**	0	**0**	2	**0**	0	**0**	0
Crew	**0**	1	**0**	1	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Passengers	**0**	3	**0**	1	**0**	0	**0**	0	**0**	2	**0**	0	**0**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0

	Accidents and serious incidents involving foreign-registered aircraft in Switzerland													
	Total		Aircraft with MTOM up to 2250 kg		Aircraft with MTOM 2250–5700 kg		Aircraft with MTOM over 5700 kg		Helicopter		Motor gliders and gliders		Balloons and airships	
	2015	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014	**2015**	2014
Accidents/ Serious incidents	**11**	11	**6**	6	**0**	0	**5**	5	**0**	0	**0**	1	**0**	0
Deceased	**1**	0	**1**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Crew	**1**	0	**1**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Passengers	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Persons seriously injured	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Crew	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Passengers	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0

Annex 4

Statistical data for the Rail and Navigation Division

Contents

1. Tables

1.1 Accidents involving persons and accidents at work

	2012			2013			2014			2015		
Number of reports / call-outs	373			379			382			296		
Investigations initiated	42			37			27			87		
Accidents involving persons Railways total (not including cableways)	**67**			**51**			**60**			**56**		
Persons injured	**†**	**S**	**L**	**†**	**S**	**L**	**†**	**S**	**L**	**†**	**S**	**L**
in a train / tram	–	1	1	–	–	–	–	1	-2	–	–	22
while boarding / alighting	–-	–	6	–	–	6	1	8	2	–	3	2
in stations	9	10	10	9	9	4	11	11	14	11	11	3
outside stations	15	11	4	13	10	5	1	3	1	10	8	8
other	–	–	–	–	–	–	1	3	1	–	–	–
Suicides* or attempted suicides* reported to STSB	**59***			**81***			**60***			**47***		
Accidents at work	**15**			**16**			**15**			**15**		

Key to statistics below:

† = Fatalities

S = Severe casualties

L = Minor injuries

*) Suicides included in our statistics were initially reported to the STSB as accidents involving persons.

1.2 Collisions and derailments

	2012			2013			2014			2015		
Collisions total	**42**			**81**			**73**			**47**		
train-train / tram-tram	7 / 0			6 / 7			7 / 5			2 / 4		
with machinery (digger, crane etc.)	3			4			8			2		
with buffers	3			2			7			2		
with parked vehicles	6			7			3			12		
with road vehicles	20			14			13			12		
with other things	3			7			6			–		
Collisions on level crossings total	**16**			**33**			**24**			**13**		
Persons injured on	†	S	L	†	S	L	†	S	L	†	S	L
manned crossings	1	1	6	4	9	6	–	9	4	1	4	2
unmanned crossings	–	3	2	2	3	15	3	7	6	–	–	–
Derailments total	**39**			**30**			**37**			**38**		
passenger train journeys	6			4			5			8		
goods train journeys	2			2			2			6		
shunting	19			20			21			20		
maintenance vehicles	8			3			6			–		
trams	4			1			3			4		

Key to statistics below:

† = Fatalities

S = Severe casualties

L = Minor injuries

*) Suicides included in our statistics were initially reported to the STSB as accidents involving persons.

1.3 Near accidents, shunting accidents and fire

	2012	2013	2014	2015
Near accidents / endangerment	**44**	**47**	**53**	**30**
Shunting accidents	**1**	**4**	**6**	**5**
Fires total	**20**	**17**	**9**	**12**
railway vehicles	9	12	4	3
scheduled buses	10	5	4	9
cableways	1	–	–	–
ships	–	–	1	–
Various	**47**	**38**	**57**	**28**
sabotage / vandalism	2	6	7	6
accidents involving dangerous goods	2	5	3	2
high-voltage accidents	7	9	14	7
other	36	18	33	13

1.4 Ship accidents, events involving cableways

	2012			2013			2014			2015		
Ships total	**1**			**3**			**2**			**3**		
Accidents involving persons Cableways total	**3**			**4**			**2**			**5**		
Persons injured in	†	S	L	†	S	L	†	S	L	†	S	L
cable cars	–	–	–	–	–	–	–	–	–	–	1	–
chairlifts	–	1	2	1	–	2	–	–	2	–	–	4
draglifts	–	–	–	–	–	–	–	–	–	–	–	–
Other cableway incidents (not including accidents at work)	**9**			**1**			**2**			**1**		
crash of cabin / chair	–			–			–			–		
deropement	2			–			1			1		
rope failures	–			–			–			–		
other	7			1			1			–		

1.5 Maritime navigation results

	2015
Notifications	**12**
Accidents	**1**

Key to statistics below:

† = Fatalities

S = Severe casualties

L = Minor injuries



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