

Swiss Transportation Safety Investigation Board STSB Annual Report 2014



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1 Editorial



For the Swiss Transportation Safety Investigation Board STSB, 2014 was characterised by significant development of resources in the Rail and Navigation Division and by the promulgation of the new Ordinance on the Safety Investigation of Transport Incidents (OSITI).

The short-fall of investigators in the Rail and Navigation Division, already evident when the STSB was established in 2011, was remedied, with no budgetary effects, by the creation of two new full-time positions, resulting in parity with the Aviation Division – each division now has five investigators. Since the director and deputy director left the STSB Rail and Navigation Division for reasons of age in the reporting year, this has resulted in a virtually complete replacement of the investigation team in this division.

In addition, the new position of a technical investigator has been established for the STSB, with the aim on the one hand of undertaking more comprehensive investigations internally,

in the laboratory now at the disposal of both divisions, and on the other hand of improving cooperation with external experts and thereby increasing efficiency and quality in relevant expert reports.

The promulgation of a single ordinance – the Ordinance on the Safety Investigation of Transport Incidents is an important milestone for the STSB in terms of safety investigations in Switzerland. At the same time the Ordinance on the Organisation of the Swiss Accident Investigation Board, the Ordinance on the Investigation of Aircraft Accidents and Serious Incidents and the Ordinance on Reporting and Investigation of Accidents and Incidents in Public Transportation were combined. Furthermore, in addition to substantive improvements, amendments were also made to international standards which are applicable in Switzerland. The Federal Council adopted the Ordinance on the Safety Investigation of Transport Incidents. in Transportation in mid-December 2014 and its entry into force was set as 1 February 2015.

Along with the new ordinance, the existing Swiss Accident Investigation Board has also changed its name; it will now be the **Swiss Transportation Safety Investigation Board STSB**. The former management body will become the Board and the technical secretariat, hitherto known as the Business Office, will now

perform its tasks as the **Investigation Bureau**. The new name of the STSB clearly indicates that investigations are exclusively concerned with the safety aspect. This also corresponds to the increased use of the term “safety investigation” at the international level and in European legislation.

André Piller
President of the Commission

2 Management Summary



The reporting year was characterised on the one hand by a below average number of accidents and serious incidents in civil aviation and on the other hand by a somewhat above average number of accidents and dangerous situations in the public transportation sector. However, the numbers are within the normal range of variation of past years and do not permit direct conclusions concerning general safety trends in the corresponding transportation sectors.

In the current annual report, among other things, there is a compilation of all safety recommendations issued by the STSB during 2014. These are accompanied by a brief introduction and the justification for them being addressed to the respective supervisory authority. Each of these safety recommendations is also accompanied by information on their implementation status—where this is already available.

On the basis of the statistical data, the analysis of significant data over a period of several years was continued. For powered aircraft with a maximum take-off mass of less than 5700 kg, for helicopters and for gliders it was thus possible to determine accident rates for the years 2007 to 2014 and to define trends. In the case of rail accidents the evolution of the absolute number of events in different accident categories was evaluated and trends were derived from this. The annual report also provides insights into the methodology of how this analysis was produced.

In 2014, a total of 1475 notifications concerning accidents and dangerous events were received by the STSB. An analysis of these notifications led to the opening of 56 safety investigations which will result in a final report. Thirty-nine investigations of accidents and serious incidents

were concluded and a further 93 clarifications and summary investigations of events of lesser importance were carried out. Within the framework of its investigations, the STSB issued a total of 33 safety recommendations during 2014.

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

3 Vision and the Swiss safety alliance



In the 2013 annual report, the STSB stated its vision and the strategy derived from it. To recap:

Vision

We are a recognised and reliable partner in the national safety system for transportation and we contribute significantly to maintaining a high safety standard and generating a basic preventive attitude.

Safety alliance

In accordance with its remit, the STSB commences its activity when an accident or a serious incident has already occurred. Despite this—actually reactive—default position, which is inherent in the system, the STSB does have the option of tackling and eliminating acknowledged safety deficits by means of safety recommendations or safety advices, thereby having a preventive effect.

However, this demands a common understanding by all partners involved in the safety system about how safety is established and how safety standards can be optimised. In this context, our partners are the supervisory authorities (the Federal Office of Civil Aviation and the Federal Office of Transport), the industry (public transport operators and airlines, training centres and the air navigation services organisation, plus infrastructure operators), but also the responsible politicians, who aim to maintain high safety standards, but at a justifiable cost.

Thanks to highly developed safety management systems with our partners, risks can be detected early and reduced by means of appropriate measures. However, safety comes at a price and is not an absolute measure; nor can safety-related efforts – as evidenced in the current report – entirely prevent mistakes by individuals or defects in technical and organisational systems.

4 Board



4.1 Review: 2014 objectives

In addition to the ongoing work on the operational side, which essentially involves the approval of final reports, the board focuses on the following areas of activity:

- Recruiting the Head of the Rail and navigation Division and the new investigators: the fact that there was a broad basis of candidates for all the open positions enabled them to be filled with appropriate and well qualified personnel.
- Adaptation of the internal working documents to the Ordinance on the Safety Investigation of Transport Incidents (OSITI), approved by the Federal Council on 17 December 2014; the new regulations now provide consistent general conditions which integrate all the provisions in the three previously existing ordinances which concerned the STSB.

It can be stated with some satisfaction that the goals specified at the beginning of 2014 have

to a large extent been achieved:

Consolidation of the organisational structure

The Organisation and Business Regulations, governing all operational procedures and processes as well as the responsibilities and competencies of employees could be brought into force in the middle of the year and adapted to the new ordinance during the second half of the year. All employees were trained in the handling of the documentation. The revision of the manuals within the divisions has been largely concluded. The concept for the Central Services, which cover all the divisions, has been adopted.

Positioning of the STSB through maintenance of the existing network of relationships and its expansion

It was possible to strengthen the essential and valuable contacts with supervisory authorities and industry in the public transportation sector. At the international level the STSB was able to present itself as the host for the meeting of the safety investigation authorities within the framework of the European Civil Aviation Conference (ECAC) in the new organisation and

draw valuable experiences from the subject of the meeting – “Accident investigation in difficult environments” – as well as maintaining old contacts and establishing new ones.

Standardisation of processes and the understanding of quality within the divisions

Despite the achievement of some goals and definite progress, there continues to be potential for optimisation in terms of increasing efficiency and effectiveness in investigation procedures and in the production of reports. It continues to be essential to devote sufficient importance to working in accordance with uniform standards and common quality criteria within the divisions.

4.2 Finances

In the reporting year the Swiss Transportation Safety Investigation Board had at its disposal a budget of CHF 9.118 million. CHF 7.886 million were actually spent. This amount covers the entire personnel and operating expenditure of the STSB. As is generally customary in other countries, the activities of the safety investigation authority are funded almost exclusively by public funds and constitute a service provided by the State to improve the transportation safety. Consequently, all STSB products, in particular the final reports of investigations, are provided free of charge on the internet. Printed and bound copies of these reports can be purchased individually or by subscription if required. The sale of these printed products raised a total of CHF 46,700 in 2014 and represents the STSB's only regular source of revenue.

4.3 Outlook for 2015

The Commission has defined the following key areas and goals for 2015:

Organisation and operation

- The Central Services have been reorganised and are being deployed across the divisions.
- The majority of investigations of accidents and serious incidents are concluded within specified periods.
- The internal basis for work (manuals within the divisions) has been established and is operational.

Staff

- The on-call service is assured.
- Existing personnel resources are being deployed primarily and in a well-balanced manner in the core area of accident investigation.
- The new employees have been inducted into their activity (initial training has been concluded).
- The training and professional development of employees is laid down in a plan which extends over several years; training which has been completed is documented in employees' dossiers.
- The position of the Technical Investigator has been filled and is operational.

Quality assurance, working climate

- An internal audit has been carried out. The focus is on an examination of operating procedures and compliance with the guidelines contained in the working documents.
- Findings and any need for action at all levels of management are being derived from the employees' survey carried out by the federal administration.

5 Investigation Bureau



5.1 Personnel

Aviation Division

The number of full-time specialists in the Aviation Division remained unchanged in 2014 at five investigators. In the middle of the year the three employees in the secretariat switched to the newly established cross-divisional Central Services, so since that time the Division has no longer operated its own secretariat.

For the full- and part-time employees, a professional development seminar was held in December 2014; this focussed on the revision of the Ordinance on the Safety Investigation of Transport Incidents (OSITI). At the end of 2014, the Aviation Division had at its disposal 84 part-time investigators for specialised technical questions and for investigation activities in cooperation with the senior investigators.

Rail and Navigation Division

In mid-2014 the Head of the Division and his deputy retired. Consequently, personnel numbers were reduced to one investigator for some months. Despite these temporarily limited personnel resources, it was possible to continuously assure the on-call service thanks to the large-scale deployment of assistant investigators.

With the recruitment of two investigators in the summer of 2014 the number of investigators increased again. In the middle of the year, the secretary of the Rail and Navigation Division was integrated into the newly established STSB Central Services.

In addition, in autumn 2014 two assistant investigators were taken on in order to supplement the pool of experts. The new recruits completed an initial day of training covering investigation procedures and methods. In the reporting year, two assistant investigators terminated their activity with the STSB. At the end of 2014, the Rail and Navigation Division had at its disposal

16 experts. These are deployed if necessary as assistant investigators for specific tasks.

As in the Aviation Division, a professional development seminar was held for all full-time and part-time employees.

5.2 Investigation activity

Aviation Division

A total of 1093 notifications were received by the Aviation Division in 2014. These events were assessed according to the provisions of the legislation; in the case of unintentional convergences of two aircraft in particular (airprox), additional technical resources were employed to assess the risk.

In the majority of cases it was possible to analyse recording devices in the organisation's own laboratory in Payerne, enabling a detailed analysis of the history of the flight.

On the basis of essential clarifications, 15 investigations of accidents and 14 investigations of serious incidents were opened, including 5 airproxes with a high or significant risk of collision, and 36 events were summarily investigated. 2014 was therefore a below average year in terms of the number of newly opened investigations.

During the same period, 24 investigations were concluded and the corresponding final report was published (cf. Annex 1). As part of the activities of the Aviation Division, 13 safety recommendations were issued.

Rail and Navigation Division

In comparison with the three preceding years, 2014 was slightly above average in terms of the number of notified events.

In August two serious events occurred: In Wolfenschiessen, three of the eight passengers in a vehicle died in the collision of a minibus with a train on an unsecured level crossing. The five other passengers were seriously injured. Two days later a Rhätische Bahn train was derailed between Tiefencastel and Filisur because of a mudslide, caused by heavy rainfall. As a result, the first passenger car behind the locomotive slid into the steep rock escarpment below the tracks. The accident claimed one life and injured ten people.

In 2014 a total of 382 notifications of accidents and hazards were received by the Rail and Navigation Division. In 27 cases investigations of accidents and serious incidents were opened; these all resulted or will result in a final report. The notifications received are sub-divided as follows into the division's four areas of activity: 334 involve the railway, 31 trams, 7 buses, 8 funicular railways and 2 vessels.

Fifty-seven other events were analysed and the investigation was concluded with a memorandum. In the reporting year the Rail and Navigation Division published 15 final reports (cf. Annex 2). To improve safety, as a result of two derailments, two interim reports were produced for the attention of the Federal Office of Transport (FOT). In total the Rail and Navigation Division issued 20 safety recommendations.

6 Safety recommendations



In the first half of the last century accidents in the transport sector were mostly investigated by the respective supervisory authorities. However, since these may be involved in the causation of 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. On the basis of the above-mentioned separation of powers, however, the investigation body cannot itself mandate measures to improve safety, but only propose these. This is achieved by the safety investigation authority – in Switzerland the STSB – highlighting the possible existence of a safety deficit to the competent supervisory authority within the framework of an interim or final report and issuing corresponding safety recommendations. It is then up to the competent supervisory authority, together with the

transport sectors 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 is intended, on behalf of the Member States, to provide uniform and binding rules on aviation safety in the European aviation sector. Since that time the EASA has been increasingly involved in exercising its authority, particularly in the areas of technology, aviation, air traffic control and aerodromes. The national supervisory authorities primarily play an executive and mediating role and their exclusive competency extends more and more only to the nationally regulated aspects of civil aviation. Since Switzerland decided to participate in the 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 jurisdiction, either to the EASA or the Federal Office of Civil Aviation.

Since Regulation (EU) No. 996/2010 of the European Parliament and Council dated 20 October 2010 on the investigation and prevention of accidents and failures in civil aviation and rescinding Directive 94/56/EG has also applied in Switzerland since 1 February 2012, the addressees of the safety recommendation are obliged, in accordance with article 18, to confirm to the STSB the receipt of the corresponding transmittal letter and within 90 days of transmission of the safety recommendation to inform it of the measures taken or considered and, where applicable, of the time required for their implementation or, if no measures are taken, to inform it of the reasons for this.

The operation of railways and inland waterway vessels, on the other hand, is regulated primarily nationally. Therefore, pursuant to article 25 paragraph 5 of the Ordinance on Notification

and Investigation of Accidents and Serious Incidents in Public Transportation (CC 742.161), which was still in force during the reporting year, all Rail and Navigation Division safety recommendations are addressed to the Federal Office of Transport (FOT).

There follows a compilation of all safety recommendations issued by the STSB during 2014 within the framework of interim or final reports. The reason behind the respective recommendation is provided in the form of a brief description of the respective accident or serious incident, as well as the safety deficit which the STSB has ascertained. The implementation status as of 1 March 2015 can be found at the end of each safety recommendation. The current implementation status of safety recommendations can be consulted on the homepage of the Swiss Transportation Safety Investigation Board.

6.1 Aviation Division

Safety Recommendation No. 478, 3.2.2014

A dangerous approach occurred in the Sitten terminal area (TMA) involving a Beechcraft A23 24, which was crossing the Rhone valley in a northerly direction, and a Piper PA-34, which was on final approach on IGS RWY 25. VMC conditions applied and the Beechcraft was flying under visual flight rules (VFR), whilst the Piper was complying with instrument flight rules (IFR) under VMC conditions.

The regional VFR chart for Sitten aerodrome did not include any VFR routes or points for departure from the TMA, respectively control zone (CTR), which would have created geographical separation between VFR and IFR traffic. On the chart there were three reporting points, which were mandatory for arriving flights only.

Safety Recommendation

The Federal Office of Civil Aviation should request that the regional VFR chart for Sitten aerodrome includes VFR routes or points for departure from the TMA/CTR, thereby establishing separation between VFR and IFR traffic.

Implementation status

Not yet implemented. However, skyguide has stated the following: *"skyguide has submitted a new "Visual Approach Chart" which takes into account the recommendations made and better separates mixed traffic between visual and instrument flights. However, this innovation also requires a change to the operating regulations for Sion aerodrome. Once this change has been approved, the new chart will be published."*

Safety Recommendation No. 479, 5.9.2014

On 2 June 2012, an R44 II helicopter took off at its own discretion from Bern regional aerodrome via taxiway KILO "around the tower" towards departure point HOTEL. Shortly thereafter there ensued the take-off of a commercial aircraft, type Dornier 328-100, from runway 32. Owing to an avoiding manoeuvre by the helicopter, there was a dangerous convergence with a high risk of collision between the two aircraft.

Within the context of the investigation several systemic points were determined which contribute to inappropriate operation with little error tolerance when runway 32 is in service.

Safety Recommendation

The Federal Office of Civil Aviation (FOCA), in cooperation with the airport operator and air traffic control, must en-

sure the establishment of a final approach and take-off area (FATO) and the establishment of departure and arrival routes for helicopters to waypoints HE, E and HW at Bern-Belp Airport.

Implementation status

Not yet implemented. However, skyguide has stated the following: *"skyguide, the airport operator and the FOCA have discussed the establishment of a FATO for improved separation of helicopter and scheduled traffic at Bern-Belp. They have decided to implement this measure with the planned airport expansion stage 4; an earlier implementation would involve major inefficiency and restrictions. As an interim solution, the current helicopter landing areas have been better described in the Swiss Aeronautical Information Publication (AIP) (March 2015)."*

Safety Recommendation No. 480, 5.9.2014

On 2 June 2012, an R44 II helicopter took off at its own discretion from Bern regional aerodrome via taxiway KILO "around the tower" towards departure point HOTEL. Shortly thereafter there ensued the take-off of a commercial aircraft, type Dornier 328-100, from runway 32. Owing to an avoiding manoeuvre by the helicopter, there was a dangerous convergence with a high risk of collision between the two aircraft.

Within the context of the investigation several systemic points were determined which contribute to inappropriate operation with little error tolerance when runway 32 is in service.

Safety Recommendation

The Federal Office of Civil Aviation, in cooperation with skyguide air navigation services, the airport operator and users of Bern-Belp airport, should carry out a comprehensive analysis of operating procedures and take all appropriate measures to reduce complexity and systemic risks.

Implementation status

Not yet implemented. However, skyguide has stated the following: *"In 2010 skyguide carried out the first so-called "Unit Safety Survey" at Bern-Belp. This method, developed by skyguide, has proved to be useful in exposing any safety risks in an operational unit. Later it was also applied fruitfully in other units."*

Since then, in Bern, it has been possible to implement or schedule implementation of individual measures derived from the survey. Expansion stage 4 of Bern-Belp aerodrome will again provide an opportunity to optimise certain procedures."

The implementation of a series of other measures, however, is associated with an adaptation of (generally political) conditions (e.g. southern approach GNSS RWY 32 for better separation of IFR and VFR traffic)."

Safety Recommendation No. 481, 15.9.2014

Since 2008, at Zurich Airport or in its immediate vicinity, comparable serious incidents such as that on 22 August 2012 have occurred in which special flights have contributed to the occurrence of the respective serious incident.

Also, in the case in question, a complex touch-and-go training flight was taking place on different runways at a time when the traffic volume was increasing and complex.

Safety Recommendation

The Federal Office of Civil Aviation (FOCA) should, in co-operation with Zurich Airport and skyguide air navigation services, lay down basic conditions for the safe handling of special flights or where necessary amend the same.

Implementation status

Partially implemented. skyguide notified the following measures: *"The VFR turns which are complex for air traffic control have been greatly restricted at Zurich airport and must additionally be linked with special conditions.*

Skyguide has included the subject of special flights in periods of heavy traffic in its ongoing training programme. It involves further increasing the already high degree of complexity of the airport system due to the handling of special flights. The findings have also been included in the "Best Practice" guide for the basic training of air traffic controllers."

Safety Recommendation No. 482, 28.11.2014

During the approach on the runway 10 instrument landing system at St. Gallen-Altenrhein, the landing flaps of the Embraer Phenom 300 remained blocked at about 10 degrees extended due to a technical abnormality and as a result could no longer be moved.

After a go-around, the aircraft was not established on the subsequent final approach and in the cockpit among other things the "TOO LOW FLAPS" acoustic alert of the terrain awareness and warning system (TAWS) sounded.

In the checklist for use of the corresponding tables for landing distance calculation, the correction factor is published only for a dry runway, but not for a wet runway.

Safety Recommendation

The European Aviation Safety Agency EASA, together with the aircraft manufacturer, should examine how the manuals can be amended to provide optimal assistance to pilots in abnormal situations.

Implementation status

Response pending

Safety Recommendation No. 483, 19.8.2014

On 11 August 2012 a near-collision occurred in the Zurich terminal area involving an Airbus A340-313 commercial aircraft and an ASW 20 glider because on the one hand the glider had penetrated into controlled airspace without clearance and on the other hand air traffic control had allowed the commercial aircraft to descend too low.

In the course of the investigation it was established that the skyguide air navigation services company had a practice of giving a so-called "anticipated clearance"; this was not a case of an "anticipated", i.e. prognosticated clearance but a clearance on the basis of an expected or prognosticated vertical flight path. This meant, both in the investigated serious incident in question and in other operational situations, that occasionally, on the assumption of a specific flight path, a clearance to descend was given which led to an infringement of the lowest permissible altitude for instrument flights in TMA LSZH 2. The concept of these "anticipated clearances" was not described anywhere in the airline's operational documents nor did any relevant training document exist. This led to different handling or rather a different interpretation of this concept by individual air traffic controllers. Both the investigated serious incident in question and the data of other flights indicate that in some cases giving clearance on the basis of an anticipated flight path is not being reliably implemented by air traffic controllers.

Safety Recommendation

The Federal Office of Civil Aviation should, together with skyguide air navigation services examine the concept of anticipated clearances and take measures which ensure that flights under instrument flight rules, when obeying clearance instructions, do not fly at altitudes or in airspace not intended for them.

Implementation status

Not yet implemented. However, skyguide has stated the following: *"The advantages and problems of "anticipated clearances" have been subject to an initial close examination by skyguide. The findings have been incorporated in ongoing training.*

Furthermore, skyguide envisages adapting the practice accordingly when the benefits of “anticipated clearances” are questionable.

A further general measure to increase awareness was operational information for air traffic controllers on the possible climb and descent behaviour of aircraft on approach.

In addition, skyguide has shared its findings from the internal investigation with Swiss International Airlines in order to also promote awareness among pilots.”

Safety Recommendation No. 484, 19.8.2014

On 11 August 2012 a near-collision occurred in the Zurich terminal management area involving an Airbus A340-313 commercial aircraft and an ASW 20 glider because on the one hand the glider had penetrated into controlled airspace without clearance and on the other hand air traffic control had allowed the commercial aircraft to descend too low.

In the course of the investigation it was established that the airspace structure around Zurich Airport imposes exacting demands on aircraft crews and air traffic controllers. This airspace structure therefore constitutes a systemic risk. In the final analysis the system is based on error-free working, and this, given normal human limitations, is based on false assumptions. The airspace is configured in such a way that even relatively small errors can lead to dangerous situations.

Safety Recommendation

The Federal Office of Civil Aviation should, if necessary in co-operation with the supervisory authorities of neighbouring states and with the involvement of the transportation operators, examine the airspace structure around Zurich Airport and take measures which simplify the use of the airspace and/or which make it more tolerant of errors.

Implementation status

Not yet implemented. However, skyguide has stated the following: “skyguide and the FOCA wish to devote special attention to a systemic improvement, namely the simplification of the terminal area structure of Zurich airport (layout, number and size of sectors).

In the meantime, skyguide has shared the findings from the internal investigation with gliding clubs in the vicinity and with Swiss International Airlines in order to also increase awareness among pilots.”

Safety Recommendation No. 488, 22.12.2014

On 26 April 2012 a Piper Cheyenne IIIA aircraft, registration D-IOSD, wanted to approach Buochs aerodrome after a flight from Germany. The pilot erroneously flew past Buochs aerodrome and descended south of it in the direction of Alpnach military aerodrome. On the incorrect as-

sumption that it was Buochs aerodrome, the pilot made an approach on Alpnach runway 01. When the mistake became obvious, the pilot initiated a go-around, in the course of which a near-collision occurred with a formation consisting of two AS332 “Super Puma” Swiss Air Force helicopters which were on approach to their Alpnach base.

As the investigation indicated, aerodrome control at Buochs and Alpnach had no radar data available relating to the flight path of the approaching aircraft. However, skyguide’s radar systems were able to monitor the flight path of D-IOSD continuously as far as approximately 2 NM south-south-west of Alpnach aerodrome at an altitude of 3500 ft QNH.

The serious incident could very probably have been avoided from the outset, if Buochs and Alpnach aerodrome control centres had had this data available.

Safety Recommendation

The Federal Office of Civil Aviation, together with the Swiss Air Force and skyguide air navigation services, should ensure that air traffic controllers on regional and military airfields have at their disposal at least the radar data already in existence in the skyguide systems, in order to improve the overview of traffic in the environs of the aerodrome.

Implementation status

Not yet implemented. However, skyguide has stated the following: “Since the serious incident, further technical developments have already taken place on several regional and military aerodromes. In addition, fairly major technical retrofits are scheduled, so eventually an improved radar display will be available to all regional and military air traffic control units which fall within the area of responsibility of skyguide or the Air Force.”

Safety Recommendation No. 489, 3.12.2014

On 24 May 2012 a commercial aircraft operating under instrument flight rules was on a visual approach on runway 32 at Bern-Belp. At the same time, a helicopter operating under visual flight rules was crossing the airport’s control zone. Traffic information was given to both aircraft and the crews confirmed that they had visual contact. A little later, in the Fokker 100 a resolution advisory (RA) was generated by the TCAS. The two aircraft finally crossed with a lateral separation of 0.7 NM and an altitude difference of 75 ft.

Since 2006 several similar serious incidents occurred at different Swiss airports with class D airspace, all in connection with dangerous convergences of two aircraft. In each case at least one of the two aircraft was equipped with a traffic alert and collision avoidance system (TCAS).

Analysis of these serious incidents indicates that information deficits exist, in particular concerning the possibilities and duties of air traffic control in Class D airspace and in relation to the consequences of the traffic alert and collision avoidance system (TCAS).

Furthermore, these investigations indicate that visual estimates of distances in three-dimensional space and their evolution over time are difficult and therefore error-prone. Compared to subjective human estimation, TCAS constitutes a technically objective warning system. The warnings generated by TCAS, in particular resolution advisories (RA), therefore indicate at least a substantial risk of collision.

The triggering of a resolution advisory also proves that the subjective estimates of the persons involved did not register the actual situation correctly, and this also is an indication that the "see and avoid" principle is subject to certain limitations.

Safety Recommendation

The European Aviation Safety Agency (EASA), in co-operation with other relevant international organisations, should examine to what extent the use of the traffic collision and avoidance system (TCAS) and the "see and avoid" principle can be better co-ordinated, in particular in airspace without defined separation criteria.

Implementation status

Response pending

Safety Recommendation No. 490, 3.12.2014

On 24 May 2012 a commercial aircraft operating under instrument flight rules was on a visual approach on runway 32 at Bern-Belp. At the same time, a helicopter operating under visual flight rules was crossing the airport's control zone. Traffic information was given to both aircraft and the crews confirmed that they had visual contact. A little later, in the Fokker 100 a resolution advisory (RA) was generated by the TCAS. The two aircraft finally crossed with a lateral separation of 0.7 NM and an altitude difference of 75 ft.

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The triggering of a resolution advisory also proves that the subjective estimates of the persons involved did not register the actual situation correctly, and this also is an indication that the "see and avoid" principle is subject to certain limitations.

Safety Recommendation

The Federal Office of Civil Aviation, in co-operation with skyguide, should take effective and simple measures which ensure that especially in class D airspace or other airspace used by commercial aircraft without separation criteria at least the protection area of commercial aircraft in which a TCAS resolution advisory is triggered is not violated.

Implementation status

Response pending

Safety Recommendation No. 491, 3.12.2014

On 24 May 2012 a commercial aircraft operating under instrument flight rules was on a visual approach on runway 32 at Bern-Belp. At the same time a helicopter operating under visual flight rules was crossing the airport control zone. Traffic information was given to both aircraft and the crews confirmed that they had visual contact. A little later, in the Fokker 100 a resolution advisory (RA) was generated by the TCAS. The two aircraft finally crossed with a lateral separation of 0.7 NM and an altitude difference of 75 ft.

Bern-Belp aerodrome control was equipped with a short-term conflict alert (STCA) system. However, the triggering of the alert had been suppressed for some years. The STCA could therefore not respond at any time in order to warn the air traffic controller of the dangerous convergence of the two aircraft.

Earlier serious incidents have already indicted that an impending conflict could have been detected and appropriately resolved earlier if the STCA safety net had been available.

Safety Recommendation

The Federal Office of Civil Aviation, together with the skyguide air navigation services company, should take all necessary measures to ensure that existing safety nets can be made available to the air traffic control units involved.

Implementation status

Partially implemented. skyguide notified the following measures: *"In October 2013, Skyguide was able to extend the STCA safety net, in the form in which it operates in Geneva and Zurich, to Bern. As a result, the instrumentation available to the Bern air traffic control centre has been improved overall."*

Safety Recommendation No. 492, 9.12.2014

On 14 March 2012 a DO328-100 aircraft wanted to make a scheduled flight from Bern-Belp (LSZB) to Vienna-Schwechat (LOWW).

After reaching cruising altitude, the CAB ALT warning appeared, indicating excessively high cabin pressure altitude. The crew donned oxygen masks on and immediately initiated an emergency descent. The crew decided to return to Bern-Belp at reduced speed. The investigation found that when the aircraft took off the forward outflow valve, used for cabin pressure regulation, had not been fully closed.

This situation was able to arise because the rotary knob to control the forward outflow valve was in an incorrect position and the crew did not notice this incorrect setting. The following factors contributed to the occurrence of the serious incident:

The control of the forward outflow valve, which is intended for manual mode, also works in automatic mode.

The position of the forward outflow valve is not indicated to the crew.

Safety Recommendation

The European Aviation Safety Agency (EASA), together with the aircraft manufacturer, should take measures to enable the crew to better detect a forward outflow valve which is not closed, especially in automatic mode.

Implementation status

Response pending.

Safety Recommendation No. 493, 15.12.2014

On 15 September 2012 a hot-air balloon took off close to Ranflüh/BE and then attempted to fly over a layer of cloud, the base of which was approximately 1900 to 2000 m AMSL. Unnoticed by the pilot, the balloon penetrated Bern-Belp regional aerodrome's terminal area. Shortly afterwards there was a near-collision involving the balloon and a Cessna R182 aircraft which was on a training flight under instrument flight rules from Berne Belp regional aerodrome.

The investigation indicated that at least for some balloon pilots a deficit exists in terms of accurate knowledge of the procedure for flying through fog and correspondingly correct application. It also became clear that no form of training is necessary for application of the procedure for flying through fog by balloon.

Safety Recommendation

The Federal Office of Civil Aviation, together with the Swiss Balloon Federation, should ensure that balloon pilots are adequately trained in the application of the procedure for flying through fog.

Implementation status

Response pending.

6.2 Rail and Navigation Division

Safety Recommendation No. 38, 9.9.2014

At 22:50 on Wednesday 21 August 2013, in Stäfa station (on the Rapperswil side) a shunting movement with rail service vehicles coming from track 4 collided with S7 train 88791 departing from platform 3 for Rapperswil. As a result of the glancing collision the front bogie of the S7 double-decker multiple-unit train was derailed. In the case of the Domino 55 type signal box, as with the Domino 69 and the small relay signal box without dwarf signals, set shunting routes are not protected from conflicting routes.

Safety Recommendation

The FOT should examine whether the individual switch setting facility present in the system should be applied when setting a shunting route using the Itis user interface, on an installation without dwarf signals.

Implementation status

The general engaging of individual switch settings as a stage in the operational process was considered not to be appropriate. The Safety Recommendation was not implemented.

Safety Recommendation No. 39, 9.7.2014

On Thursday, 7 March 2013 shortly after 09:40, the front bogie of a new, unequipped Siemens low-level double-decker wagon was derailed on a transfer journey at the double-slip diamond crossing at the Bern Weyermannshaus departure point for Freiburg with train 69824. As a result of the derailment, the derailed wagon rose up into the clearance space of the adjacent track. At the same moment BLS rapid-transit train 15133 was travelling past in the opposite direction and its top front corner grazed the derailed low-level double-decker wagon.

Rolling stock which are too closely coupled generate high buffer forces, which in combination with other factors which are difficult to influence may cause wheels to ride up.

Safety Recommendation

In consideration of the difference between the reference coupling condition accepted by Siemens for the low-level double-decker wagon project (2x5 turns) and the SBB coupling regulations for modern passenger cars (2x3 turns), the STSB is advising the FOT to uniformly regulate the regulations concerning grooves.

Implementation status

Not implemented.

From the viewpoint of the FOT this is a matter of concrete, vehicle-specific procedural instructions, which have to be matched individually by the company to its vehicles and not defined at a higher level.

Safety Recommendation No. 42, 13.8.2014

On 6 September 2012 a goods railcar of the Aare Seeland mobil company was operating as a loco train from Bannwil to Langenthal. On entering Langenthal station the engine driver initiated braking on the upward gradient as far as switch 7, to reduce speed to 25 km/h. He stated that the speed decreased only slowly and he increased braking to the full braking position. On entering the occupied track Q1, the railcar collided with multiple unit Be 4/8.

Since visibility of the position of the steering controller was impaired, on entering the occupied track Q1 in Langenthal the engine driver did not notice that the controller was still at stage 8 and De 4/4 was still exerting traction.

Safety Recommendation

The visibility of the position of the De 4/4 controller should be improved, for example by removing the metal strip and highlighting the position indicator in white.

Implementation status

Implemented.

Safety Recommendation No. 43, 13.8.2014

On 6 September 2012 a goods railcar of the Aare Seeland mobil company was operating as a loco train from Bannwil to Langenthal. On entering Langenthal station the engine driver initiated braking on the upward gradient as far as switch 7, to reduce speed to 25 km/h. He stated that the speed decreased only slowly and he increased braking to the full braking position. On entering the occupied track Q1, the railcar collided with multiple unit Be 4/8.

Subsequently the engine driver ascertained through a braking test that the brake was functioning correctly, but the controller was at stage 8 and the goods railcar was still exerting traction. The engine driver set the controller and reverser to 0.

Safety Recommendation

During training of locomotive personnel the special character of the operation of the controller and driver's brake valve of the De 4/4 should be dealt with repeatedly, so that lessons can be learnt from this accident.

Implementation status

Implemented.

Safety Recommendation No. 44, 13.8.2014

On 6 September 2012 a goods railcar of the Aare Seeland mobil company was operating as a loco train from Bannwil to Langenthal. On entering Langenthal station the engine driver initiated braking on the upward gradient as far as switch 7, to reduce speed to 25 km/h. He stated that the speed decreased only slowly and he increased braking to the full braking position. On entering the occupied track Q1, the railcar collided with multiple unit Be 4/8.

Subsequently the engine driver ascertained through a braking test that the brake was functioning correctly, but the controller was at stage 8 and the goods railcar was still exerting traction.

Safety Recommendation

In the operating instructions for goods railcar De 4/4 321, the effects of the rapid braking position of the driver's brake valve should be described.

Implementation status

Implemented.

Safety Recommendation No. 45, 10.12.2014

At approximately 01:18 on Saturday 16 February 2013, a rapid-transit double-decker train was derailed owing to a broken rail between Schwerzenbach and Nänikon-Greifensee. No-one was injured. There was substantial material damage to the infrastructure installations and to the rolling stock. The primary rail break occurred when a service train passed through shortly before the derailed train.

The rail had already been damaged before the derailment by different forms of rolling fatigue.

Safety Recommendation

The time interval between ultrasound measurements on sections subjected to heavy loads should be examined.

Implementation

Response pending.

Safety Recommendation No. 46, 10.12.2014

At approximately 01:18 on Saturday 16 February 2013, a rapid-transit double-decker train was derailed owing to a broken rail between Schwerzenbach and Nänikon-Greifensee. No-one was injured. There was substantial material damage to the infrastructure installations and to the rolling stock. The primary rail break occurred when a service train passed through shortly before the derailed train.

The rail had already been damaged before the derailment by different forms of rolling fatigue.

Safety Recommendation

The necessary intervals for grinding the rails should be examined as a function of the load on the section as well as the permitted speed.

Implementation status

Response pending.

Safety Recommendation No. 47, 10.12.2014

At approximately 01:18 on Saturday 16 February 2013, a rapid-transit double-decker train was derailed owing to a broken rail between Schwerzenbach and Nänikon-Greifensee. No-one was injured. There was substantial material damage to the infrastructure installations and to the rolling stock. The primary rail breakage occurred when a service train passed through shortly before the derailed train.

The driver of the service train had lodged a report with the dispatcher.

Safety Recommendation

During internal training, dispatchers should be made aware of the great value of reports by drivers relating to damage/incidents on the track.

Implementation status

Response pending.

Safety Recommendation No. 56, 21.10.2014

At 16:30 on Thursday 28 February 2013, a service wagon on service train 32463 was derailed in Kloten Dorfnest. No one was injured. There was substantial material damage to the SBB infrastructure installations and to the derailed wagon. Wagons which have not been used for some time may exhibit damage which adversely affects serviceability and may cause derailment.

Safety Recommendation

Wagons which have been out of service for some time should be included in a train only after a technical inspection by a suitably trained train preparer (a technical inspector) or an appropriate technical manager of a railway operator.

Implementation status

On the basis of the results of the final report, the Federal Office of Transport (FOT) considers the safety recommendation to be useful in principle. According to the FOT, the current regulatory requirements mean that the safety recommendation has already been implemented.

Safety Recommendation No. 57, 21.10.2014

At 16:30 on Thursday 28 February 2013, a service wagon on service train 32463 was derailed in Kloten Dorfnest. No one was injured. There was substantial material damage to the SBB infrastructure installations and to the derailed wagon. The railway operator included the service wagon in train 32463, even though it was not listed in the "Mikado 1244" rolling stock register and the designations on the wagon did not comply with the regulations according to AB EVB.

Safety Recommendation

The railway companies should include in their trains only those wagons which are listed in their rolling stock register. The train preparer should examine with the aid of appropriate documents whether the vehicles making up the train are certificated for transportation by the responsible railway operator (safety certificate with vehicle list in the form of an excerpt from the rolling stock register).

Implementation status

On the basis of the results of the final report, the Federal Office of Transport (FOT) considers the safety recommendation to be useful in principle. According to the FOT, the current regulatory requirements mean that the safety recommendation has already been implemented.

Safety Recommendation No. 58, 1.7.2014

At 18:44 on Monday 29 July 2013, Payerne-Lausanne regional train 12976 collided in Granges-Marnand station with Lausanne-Payerne RegioExpress 4049. At the time of the collision, train 12976 was travelling at a residual velocity of 60 km/h and train 4049 at 45 km/h. Of the 45 passengers who were in the two trains 26 were injured, 6 seriously. The driver of train 4049 died at the site of the accident.

The signal box at Granges-Marnand station, which came into service in 1975, no longer corresponds in its entirety to current technical standards and operating procedures. In local operation, the driver alone is responsible for the train's departure. This means that a single human failure can cause a hazard or an accident.

Safety Recommendation

Granges-Marnand station is to be equipped with the Euro-ZUB train control system in accordance with the guidelines of SBB regulations I 20027 dated 1.2.2012.

Implementation status

Implemented. Granges-Marnand station has been equipped with a speed monitoring system since April 2014.

Safety Recommendation No. 59, 1.7.2014

At 18:44 on Monday 29 July 2013, Payerne-Lausanne regional train 12976 collided in Granges-Marnand station with Lausanne-Payerne RegioExpress 4049. At the time of the collision, train 12976 was travelling at a residual velocity of 60 km/h and train 4049 at 45 km/h. Of the 45 passengers who were in the two trains 26 were injured, 6 seriously. The driver of train 4049 died at the site of the accident.

The signal box at Granges-Marnand station, which came into service in 1975, no longer corresponds in its entirety to current technical standards and operating procedures. In local operation, the driver alone is responsible for the train's departure. This means that a single human failure can cause a hazard or an accident.

Safety Recommendation

In the setting of priorities for equipping stations with the Euro-ZUB train control system, more weight should be given to those stations in which trains occasionally cross. In addition, human factors must be taken into consideration, e.g. the dangers which result from routine, personnel stress, train movement and duty shifts.

Implementation status

Equipping the 21 remote-controlled crossing stations with a speed monitoring system will be completed by the end of 2015.

Safety Recommendation No. 60, 1.7.2014

At 18:44 on Monday 29 July 2013, Payerne-Lausanne regional train 12976 collided in Granges-Marnand station with Lausanne-Payerne RegioExpress 4049. At the time of the collision, train 12976 was travelling at a residual velocity of 60 km/h and train 4049 at 45 km/h. Of the 45 passengers who were in the two trains 26 were injured, 6 seriously. The driver of train 4049 died at the site of the accident.

The inadequate system in the procedure for emergency switch-off of the catenaries in manned stations by the dispatcher and the lack of reciprocal information for the units involved are a safety deficit.

Safety Recommendation

Personnel must be instructed in switching off catenaries in emergencies until remote control of stations is completely centralised (temporary presence of a dispatcher) and there is a possibility of switching off the catenaries in an emergency.

Implementation status

Implemented.

Safety Recommendation No. 61, 1.7.2014

At 18:44 on Monday 29 July 2013, Payerne-Lausanne regional train 12976 collided at switch 1 in Granges-Marnand station with Lausanne-Payerne RegioExpress 4049 1. At the time of the collision, train 12976 was travelling at a terminal velocity of 60 km/h and train 4049 at 45 km/h. Of the 45 passengers who were in the two trains 26 were injured, 6 seriously. The driver of train 4049 died at the site of the accident.

Safety Recommendation

The formulation and the stages of the "Geste métier" (prescribed operational sequence) for train departures should be revised in such a way that uniform application of the procedure is ensured.

Implementation status

The "Geste métier" was examined by an SBB working group and found to be appropriate. The recommendation was therefore not implemented.

Safety Recommendation No. 65, 11.12.2014

At 12.02 on Friday 18 October 2013 a person entered a pedestrian crossing on the Avenue d'Echallens in Lausanne when Chemin de fer Lausanne-Echallens-Bercher (LEB) trains no. 27 approached the pedestrian crossing in the direction of Echallens. Despite a warning signal and emergency braking, the collision of the train with the pedestrian could not be avoided. The pedestrian died at the site of the accident. Since the introduction of the quarter-hourly service between Lausanne and Cheseaux, the risk of an accident involving a pedestrian or a road vehicle has increased proportionally. On the section concerned the proximity of the road, railway and pedestrian traffic is problematic.

Safety Recommendation

In view of the increase in road and rail traffic, the urban section of the LEB should be moved into a tunnel.

Implementation status

Response pending.

Safety Recommendation No. 66, 11.12.2014

At 12.02 on Friday 18 October 2013 a person entered a pedestrian crossing on the Avenue d'Echallens in Lausanne when Chemin de fer Lausanne-Echallens-Bercher (LEB) trains no. 27 approached the pedestrian crossing in the direction of Echallens. Despite a warning signal and emergency braking, the collision of the train with the pedestrian could not be avoided. The pedestrian died at the site of the accident. Since the train travels, unusually, on the same track in both directions, pedestrians have not got used to ensuring that a train is not approaching from the opposite direction before crossing the public transport lane. The "Strassenbahn" (tramway) signal with an additional panel, which draws the attention of pedestrians to the fact that the train runs in both directions does not seem to be sufficient to direct pedestrians' attention to the opposite direction as well as the normal one.

Safety Recommendation

Until the urban section of the rail line has been moved into a tunnel, pedestrian traffic lights should be installed, preventing pedestrians from crossing the public transport lane when a train is approaching.

Implementation status

Response pending.

Interim reports

In accordance with Article 24 of the Ordinance on the Notification and Investigation of Accidents and Serious Incidents in Public Transportation (VUU), the STSB immediately communicates to the FOT the essential results of investigations which are important for accident prevention and which might require immediate measures in an interim report with the appropriate recommendations.

In 2014, the STSB produced two interim reports for the FOT. These contain four safety recommendations in total.

Safety Recommendation No. 72, 16.10.2014

On Wednesday 11 June 2014 at Ebikon station, two goods wagons on a shunting journey were derailed at switch 11. No-one was injured. Substantial damage was caused to the infrastructure and rolling stock.

On the Migros rail siding, bitumen, which is used as a sealing compound in the rail joints, managed to get onto the rail profile. When they travelled over these contaminated areas, the running surfaces of the wheels of the shunting train were badly contaminated.

This contamination led to electrical isolation of the wheel from the rail and thus to a clear signal for the section of the rail in the area of set of points 11. On running over set of points 11, these points were switched back under the wagons because of the way the system operates.

Safety Recommendation

The FOT should examine installations of identical construction, particularly with regard to the effect of joint sealing compound on railway track and running surfaces, take appropriate measures and if necessary examine how the problem can be dealt with.

Implementation status

The FOT is in agreement with Safety Recommendation No. 72 expressed in the interim report and will implement it by arrangement with the Safety Monitoring section.

Safety Recommendation No. 73, 7.11.2014

On Wednesday, 16 July 2014 railcar no. 46 (year of construction 1968) was derailed. The cause of the derailment was a wheel disc fracture. The railcar was scrapped.

On Tuesday, 30 September 2014, Appenzeller Bahnen trailer B 245 (year of construction 1964) was derailed in Jakobsbad station because of a wheel disc fracture.

On the Appenzeller Bahnen route network, the speed through curves was increased in some sections from 40 km/h to 45 km/h. This leads to an increase in lateral acceleration of 20%.

In the course of time cracks formed in the wheel discs. The fatigue strength of the wheel discs of the 1964–1968 series is no longer guaranteed. Under these circumstances, further wheel disc fractures are possible at any time.

Safety Recommendation

The Federal Office of Transport should ensure that all wheel discs on identically constructed vehicles (1964–1968 series) are replaced.

Implementation status

Being implemented. When the wheels are replaced, Appenzeller Bahnen must provide evidence for the strength of these in accordance with the current standard SN EN 13749-1. All rolling stock of this part of the fleet must be taken out of service by AB until the wheels are replaced. In addition we shall inform AB that when the wheels are replaced the wheel set axles, which are of comparable relevance to safety, must be inspected using non-destructive testing.

Safety Recommendation No. 74, 7.11.2014

On Wednesday, 16 July 2014 railcar no. 46 (year of construction 1968) was derailed. The cause of the derailment was a wheel disc fracture. The railcar was scrapped.

On Tuesday, 30 September 2014, Appenzeller Bahnen trailer B 245 (year of construction 1964) was derailed in Jakobsbad station because of a wheel disc fracture.

On the Appenzeller Bahnen route network, the speed through curves was increased in some sections from 40 km/h to 45 km/h. This leads to an increase in lateral acceleration of 20%.

In the course of time cracks formed in the wheel discs. The fatigue strength of the wheel discs of the 1964–1968 series is no longer guaranteed. Under these circumstances, further wheel disc fractures are possible at any time.

As a result of the increase in lateral acceleration in curves the wheel is subjected to higher loadings. Because of this, cracks may also occur on the other rolling stock.

Safety Recommendation

The Federal Office of Transport should ensure that a magnetic particle test is arranged for all wheel discs on the other vehicles.

Implementation status

Being implemented.

Appenzeller Bahnen must carry out non-destructive testing of the wheels on all other vehicles. In this context, the FOT would also accept ultrasonic testing as equivalent, instead of the more difficult magnetic particle test.

Safety Recommendation No. 75, 7.11.2014

On Wednesday, 16 July 2014 railcar no. 46 (year of construction 1968) was derailed. The cause of the derailment was a wheel disc fracture. The railcar was scrapped.

On Tuesday, 30 September 2014, Appenzeller Bahnen trailer B 245 (year of construction 1964) was derailed in Jakobsbad station because of a wheel disc fracture.

On the Appenzeller Bahnen route network, the speed through curves was increased in some sections from 40 km/h to 45 km/h. This leads to an increase in lateral acceleration of 20%.

In the course of time cracks formed in the wheel discs. The fatigue strength of the wheel discs of the 1964 - 1968 series is no longer guaranteed. Under these circumstances, further wheel disc fractures are possible at any time.

As a result of the increase in lateral acceleration in curves the wheel is subjected to higher loadings. Because of this, cracks may also occur on the other vehicles.

Safety Recommendation

The Federal Office of Transport should ensure that the maximum permitted speed through curves is reset to the original value in order to reduce the loading on wheel discs in curves.

Implementation status

Given implementation of Safety Recommendations Nos. 73 and No. 74 by Appenzeller Bahnen we consider the implementation of Safety Recommendation No. 75 not to be necessary at the present time. However, if cracks are also discovered in newer rolling stock, the implementation of Safety Recommendation No. 75 should be re-examined.

7 Analysis



7.1 Analysis of the statistical data of the Aviation Division

By analogy with the analyses in the 2013 annual report, the statistical data for the past seven years has also been analysed for this annual report. It is possible to make the following statements concerning the evolution of aviation safety in Switzerland.

Measured variable, method and comparisons

The accident statistics do not compare absolute but relative accident figures, termed accident rates. This means that consideration is given to how many accidents per 1 million flight movements have occurred. Accident rates always refer to a specific year and a specific category of aircraft.

A distinction is made between the following aircraft categories in the accident statistics:

- Powered aircraft with a maximum take-off mass of 5700 kg;
- Gliders, including powered gliders and touring powered 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 of an accident, and at least one person must have been seriously or fatally injured.

In order to make a statement about whether a data value is located within or outside a range of variations regarded as usual, the multiple of the estimated standard deviation σ was calculated for each annual number of events. In the standard normal distribution the range between -1σ and $+1 \sigma$ is considered as the usual range of variation. Values less than -1σ are considered as an improvement in safety; values greater than $+1 \sigma$ are considered as a deterioration of safety.

In addition to the analyses to date, for the present annual report it was calculated whether the events of the three categories have generally increased or decreased over the last seven years (the trend). The criterion was the gradient of the straight lines of a simple linear regression. A gradient with a plus sign means a deterioration of safety; a gradient with a minus sign means an improvement in safety.

Caution must be exercised when further interpreting the statistics. There is a danger of making inadmissible statements. Because of the partially different collection of aircraft movements, it is, for example, problematic to compare the safety of the three analysed aircraft categories on the basis of the data in the following figure. 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 measured variable applied, 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 2014 was an average to above-average year in terms of safety for Swiss civil aviation.

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

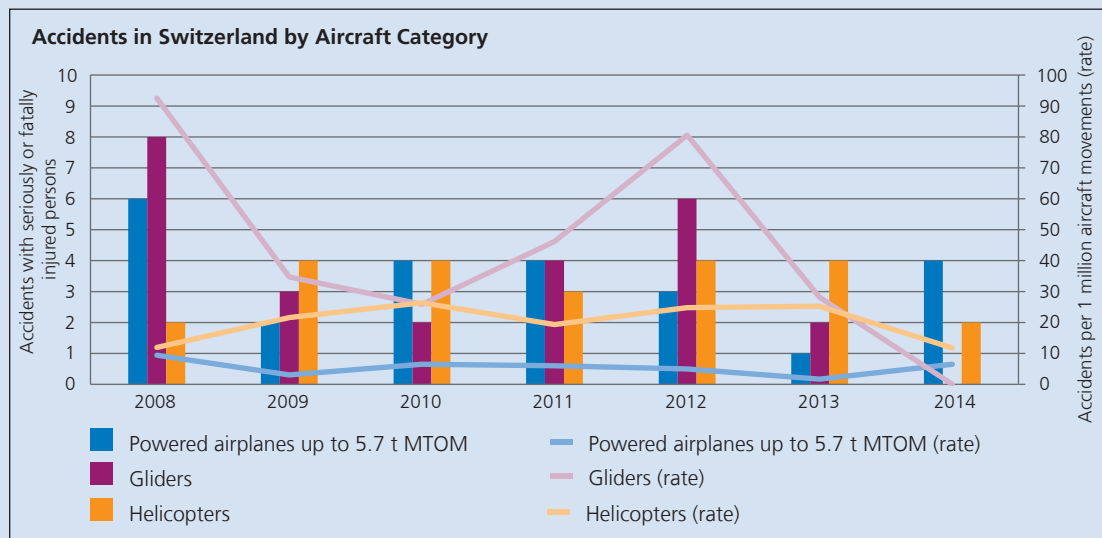
- For powered aircraft with a maximum take-off weight up to 5700 kg the accident rate was approximately 6.5 accidents per million aircraft movements. This corresponds to ap-

proximately $+0.4 \sigma$ in the standard normal distribution and is therefore within the normal range for the years 2008 to 2014. The trend is negative (-0.3 accidents per year).

- For gliders, the accident rate was approximately 0 accidents per million aircraft movements (i.e. no accident meeting the above-mentioned definition occurred in the entire year). This corresponds to approximately -1.4σ in the standard normal distribution and is therefore within the range of unusually low accident rates. The trend is negative (-0.8 accidents per year).
- For helicopters the accident rate was approximately 12 accidents per million aircraft movements. This corresponds to approximately -1.4σ in the standard normal distribution and is within the range of unusually low accident rates. The trend is neutral (0.0).

If the unusually low accident rate for gliders and helicopters is not actually due to chance, we can assume an improvement in safety for these aircraft categories. The clear negative trend for gliders indicates an improvement in safety for this aircraft category. It is not possible to determine from the existing statistical data where the improvements in safety originate.

The following graph shows the absolute numbers of accidents and the accident rates for the three aircraft categories analysed in the years 2008 to 2014.



Absolute numbers of accidents and the accident rates for the three aircraft categories in the years 2008 to 2014.



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

By analogy with the analyses in the 2013 annual report, the statistical data for the past seven years has also been analysed for this annual report. It is possible to make the following statements concerning the evolution of safety in the operation of railways, buses and funicular railways.

Measured variable, method and comparisons

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

- Collisions on protected level crossings
- Collisions on unprotected level crossings
- Other collisions (including trams)
- Derailments (including trams)
- Fires (including buses)

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 range of variations regarded as usual, the multiple of the estimated standard deviation σ was calculated for each annual number of events. In the standard normal distribution the range between -1σ and $+1 \sigma$ is considered as the usual range of variation. Values less than -1σ are considered as an improvement in safety; values greater than $+1 \sigma$ are considered as a deterioration of safety. Further details on the statistical method are given in section 7.2 of the 2013 annual report.

In addition to the analyses to date, for the present annual report it was calculated whether the events of the five categories have generally increased or decreased over the last seven years (the trend). The criterion was the gradient of the straight lines of a simple linear regression. A gradient with a plus sign means a deterioration of safety; a gradient with a minus sign means an improvement in safety.

Because of the partially differently regulated obligation to notify, a possibly different reporting culture and different definitions, delimitations and conditions for including an event in the statistics, caution is required for 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 danger of making inadmissible statements.

Statements concerning the safety of railways, buses and funicular railways

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

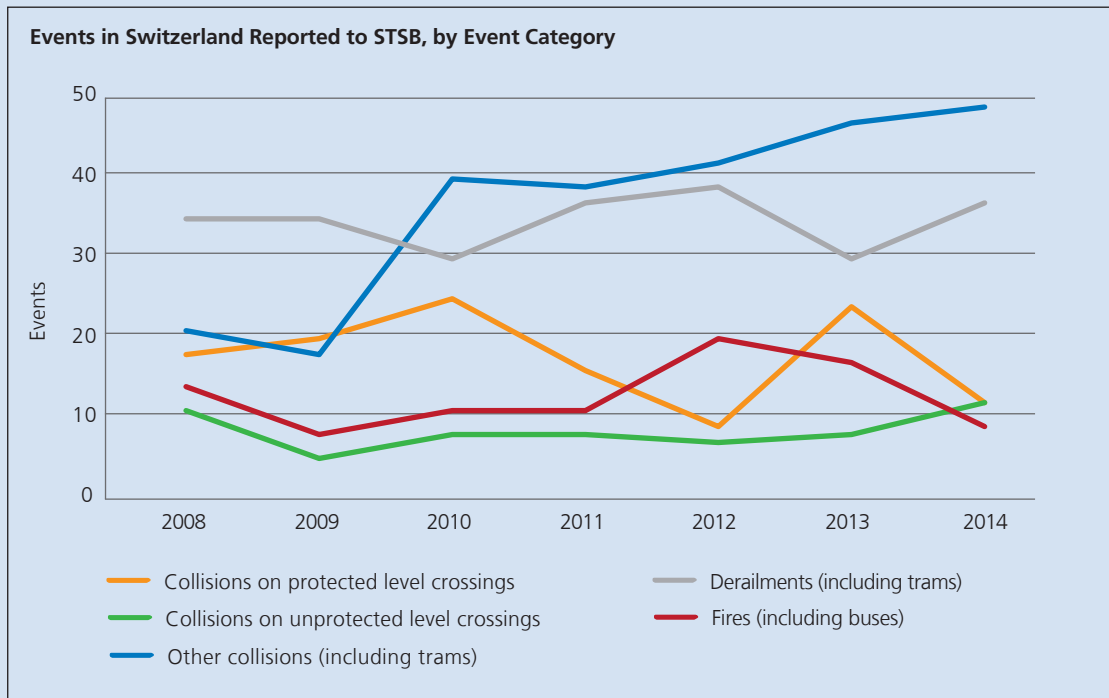
- There were 12 collisions on protected level crossings. This corresponds to approximately -0.97σ in the standard normal distribution and is therefore within the usual range for the years 2008 to 2014. The trend is negative (-0.9 events per year).
- There were 12 collisions on unprotected level crossings. This corresponds to approximately $+1.5 \sigma$ in the standard normal distribution and is therefore within the range of unusually high accident rates. The trend is positive ($+0.3$ events per year).
- There were 49 other collisions (including trams). This corresponds to approximately $+1.02 \sigma$ in the standard normal distribution and is therefore within the range of the unusually high accident rates, but only just. The trend is positive ($+5.1$ events per year).
- There were 37 derailments (including trams). This corresponds to approximately $+0.65 \sigma$ in the standard normal distribution and is therefore within the usual range for the years 2008 to 2014. The trend is positive ($+0.2$ events per year).
- There were 9 fires (including buses). This

corresponds to approximately -0.88σ in the standard normal distribution and is therefore within the usual range for the years 2008 to 2014. The trend is positive ($+0.4$ events per year).

On the basis of these findings the STSB concludes that overall 2014 was an average year in terms of safety for the operation of railways, buses and funicular railways in Switzerland.

However, the results do give rise to controversial discussions. On the one hand it is pleasing that collisions on protected level crossings are generally decreasing. On the other hand it must be pointed out that the event categories "Collisions on unprotected level crossings" and "Other collisions" both exhibited record values in 2014. Also, the trend for these two categories is positive, i.e. towards more events. Though the trend for collisions on unprotected level crossings was only just positive, this is surprising in view of the fact that the number of unprotected level crossings is generally decreasing. More attention must be paid to the event category "Other collisions" where the trend was an average of 5.1 additional events per year.

The following diagram shows the numbers of events for the five event categories analysed for the years 2008 to 2014.



Annexes



Annexes

Annex 1: List of published final reports of the Aviation Division of the Swiss Transportation Safety Investigation Board STSB in 2014

Annex 2: List of published final reports of the Rail and Navigation Division of the Swiss Transportation Safety Investigation Board STSB in 2014

Annex 3: Statistical data Aviation Division

Annex 4: Statistical data Rail and Navigation Division

Annex 1

List of published final reports of the Aviation Division of the Swiss Transportation Safety Investigation Board in 2014

| Number | Identification | Date | Location | Safety recommendation |
|--------|------------------------------|------------|-------------------------------|-----------------------|
| 2106 | HB-PQJ | 21.02.2009 | Monthey/VS | --- |
| 2170 | HB-PPV | 06.02.2012 | Grünenmatt/BE | --- |
| 2180 | HB-CQW | 27.11.2011 | Kappel a. Albis/ZH | --- |
| 2197 | D-0251 | 19.05.2012 | Klausenpass/UR | --- |
| 2199 | HB-IXW | 02.07.2012 | Region Rolampont (RLP/F) | --- |
| 2200 | Airprox HB-LMM/HB-ENV | 22.02.2012 | Sion/VS | 478 |
| 2202 | Airprox SRK700/HB-ZSA | 02.06.2012 | Bern | 479 - 480 |
| 2203 | Airprox DWT124/HB-WYC | 22.08.2012 | Zürich | 481 |
| 2204 | HB-3287 | 25.07.2013 | Gemeinde Obergoms/VS | --- |
| 2205 | CN-MBR | 06.08.2012 | Altenrhein/SG | 482 |
| 2207 | HB-ZJO | 18.09.2012 | Maggia/TI | --- |
| 2208 | Airprox SWR39/HB-1519 | 11.08.2012 | Zürich | 483 - 484 |
| 2211 | Airprox RYR3595/TAP706 | 12.04.2013 | Zürich | --- |
| 2212 | HB-2202 | 17.06.2013 | Grenchen/SO | --- |
| 2213 | HB-CFF | 14.02.2013 | Buttwil/AG | --- |
| 2214 | HB-FKT | 07.05.2013 | Glacier du Trient/VS | --- |
| 2218 | Airprox Glider/SWR63M/SWR78W | 08.05.2013 | Zürich | --- |
| 2219 | Airprox D-IOSD/T322-T314 | 26.04.2012 | Alpnach/OW | 488 |
| 2220 | Airprox REGARC/OAW5311 | 24.05.2012 | Bern | 489 - 491 |
| 2221 | Airprox BAW3ZL/HB-ZUV | 29.05.2012 | Zürich | --- |
| 2222 | HB-AES | 14.03.2012 | 20 km South of Zurich Airport | 492 |
| 2223 | Airprox HB-ZFM/HB-CNI | 05.09.2012 | Emmen/LU | --- |
| 2224 | Airprox HB-CLU/HB-QIK | 15.09.2012 | Bern | 493 |
| 2225 | HB-XPQ | 24.05.2012 | Reichenbach/BE | --- |

Annex 2

List of published final reports by the Rail and Navigation Division of the Swiss Transportation Safety Investigation Board in 2014

| Number | Type of operation | Type of accident | Date | Location | Safety recommendation |
|------------|-------------------|--|------------|--------------------|-----------------------|
| 2013022801 | Rail | Derailment | 28.02.2013 | Kloten | 56, 57 |
| 12090101 | Rail | Fire | 01.09.2012 | Stansstad | – |
| 12090601 | Rail | Collision | 06.09.2012 | Langenthal ASM | 42, 43, 44 |
| 2013082101 | Rail | Collision | 21.08.2013 | Stäfa | 38 |
| 2013021601 | Rail | Derailment | 16.02.2013 | Schwerzenbach | 45, 46, 47 |
| 2013022301 | Rail | Collision on protected rail crossing | 23.02.2013 | Frauenfeld | – |
| 2013030702 | Rail | Derailment | 07.03.2013 | Bern Weyermannhaus | 39 |
| 2013072902 | Rail | Collision | 29.07.2013 | Granges-Marnand | 58, 59, 60, 61 |
| 2013091602 | Rail | Near accident / train endangerment | 16.09.2013 | Granges-Marnand | 58, 59, 61 |
| 2013061203 | Tram | Collision | 12.06.2013 | Oberwil | – |
| 2013070601 | Tram | Collision | 06.07.2013 | Zürich | – |
| 2013042601 | Rail | Collision | 26.04.2013 | Spiez | – |
| 2013092601 | Rail | Collision on protected rail crossing | 26.09.2013 | Niederdorf | – |
| 2013101802 | Rail | Accident to person | 18.10.2013 | Lausanne | 65, 66 |
| 2013112501 | Rail | Collision on unprotected rail crossing | 25.11.2013 | Mörel | – |

Annex 3

Statistical data, Aviation Division

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1. Preliminary remarks

Aircraft accident investigation seeks to prevent similar accidents and serious incidents by clarifying the circumstances and causes.

The legal assessment of accidents is not the subject of the investigation or investigation reports.

The following annual statistic includes all investigated accidents and serious incidents to Swiss civil registered aircraft at home and abroad, as well as foreign-registered aircraft in Switzerland.

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

2. Definitions

A number of terms which are of significance are explained below, in accordance with the Ordinance on Investigation of Aircraft Accidents and Serious Incidents.

Aircraft accident

Occurrence in the operation of an aircraft, if a person is inside it with the intention of making a flight:

- (a) in which a person inside or outside of the aircraft is seriously injured or killed; or
- (b) in which the aircraft suffers damage which substantially adversely affects stability, performance or the flight characteristics and generally requires usually major repair work or replacement of the damaged component; or
- (c) in which the aircraft is lost or the wreckage is inaccessible.

The following are not deemed to be aircraft accidents:

Deaths and injuries which are not directly related to the operation of an aircraft; deaths and injuries to people who are unjustifiably outside the areas intended for crew and passengers; in addition, engine failures and damage limited to only one engine, its auxiliary power units or the propeller blades; damage to panels, minor deformation or small holes in the outer skin; damage to the wingtips and rotor blade tips, antennas, tyres or brakes.

Serious injury

Injury suffered by a person in an aircraft accident and which has one of the following characteristics:

- (a) it requires a hospital admission within seven days and of more than 48 hours;
- (b) it consists of a bone fracture; simple fractures of fingers, toes or nose are excluded;
- (c) it consists of cuts or lacerations which result in heavy bleeding, damage to a nerve, a muscle or a tendon;
- (d) it results in damage to an internal organ;
- (e) it consists of 2nd or 3rd degree burns or burns covering more than 5% of the surface of the body;
- (f) it is attributable to detectable infectious substances or harmful radiation.

Fatal injury

Serious injury resulting in death within 30 days of the accident.

Large aircraft

Aircraft with a maximum permissible take-off mass (MTOM) of at least 5700 kg, classified in the standard airworthiness category, transport subcategory, or which has more than ten seats for passengers and crew.

Country of registration

State in whose aircraft register the aircraft is registered.

Country of manufacture

The State or States which have certified the airworthiness of the prototype.

Operator State

State in which the air traffic operator has its headquarters or its permanent seat.

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 |
|-------------|---|----------------------------|---|----------------------------------|---|---------------------------|---|------------------------------------|---|--------------------|
| 2003 | 3 972 | 873 540 | 16 936 | 38 | 32 | 70 | 18 | 19 | 88 | 24 |
| 2004 | 3 893 | 749 535 | 16 382 | 29 | 34 | 63 | 10 | 14 | 73 | 14 |
| 2005 | 3 841 | 768 643 | 15 501 | 22 | 37 | 59 | 12 | 9 | 71 | 15 |
| 2006 | 3 822 | 715 572 | 15 368 | 27 | 31 | 58 | 10 | 7 | 68 | 10 |
| 2007 | 3 813 | 766 557 | 15 076 | 23 | 20 | 43 | 4 | 6 | 47 | 12 |
| 2008 | 3 765 | 784 548 | 14 691 | 28 | 19 | 47 | 5 | 6 | 52 | 11 |
| 2009 | 3 685 | 842 017 | 14 973 | 26 | 17 | 43 | 4 | 3 | 47 | 5 |
| 2010 | 3 705 | 793 592 | 15 313 | 21 | 16 | 37 | 8 | 4 | 45 | 8 |
| 2011 | 3 709 | 873 548 | 12 855 ³⁾ | 21 | 24 | 46 | 13 | 8 | 59 | 13 |
| 2012 | 3 657 | 875 708 | 12 840 | 22 | 20 | 42 | 23 | 10 | 65 | 22 |
| 2013 | 3 620 | 933 752 | 11 871 | 28 | 16 | 44 | 20 | 11 | 64 | 15 |
| 2014 | 3 556 | 919 987 | 11 563 | 18 | 28 | 46 | 13 | 5 | 59 | 8 |

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 |
|-------------|---|----------------------------|----------------------------------|---|---------------------------|---|------------------------------------|---|--------------------|
| 2003 | 257 | 504 998 | 3 | 0 | 3 | 18 | 19 | 21 | 0 |
| 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 |

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 reg- istered aircraft ¹⁾ | Flight hours ¹⁾ | Number of ac- cidents investi- gated | Num- ber of acci- dents with sum- mary investi- gations | Total num- ber of acci- dents | Num- ber of serious incidents (incl. Airprox) | Airprox investi- gated ²⁾ | Total number of acci- dents and serious incidents | Number of de- ceased |
|-------------|--|----------------------------|--|---|-------------------------------------|--|---|--|-------------------------|
| 2003 | 3 715 | 368 542 | 35 | 32 | 67 | 0 | 0 | 67 | 24 |
| 2004 | 3 645 | 313 715 | 28 | 34 | 62 | 0 | 0 | 62 | 14 |
| 2005 | 3 600 | 323 415 | 22 | 37 | 59 | 0 | 0 | 59 | 15 |
| 2006 | 3 574 | 281 522 | 26 | 31 | 57 | 2 | 0 | 59 | 10 |
| 2007 | 3 553 | 373 189 | 20 | 20 | 40 | 4 | 1 | 44 | 11 |
| 2008 | 3 480 | 398 862 | 27 | 19 | 46 | 2 | 1 | 48 | 11 |
| 2009 | 3 392 | 447 962 | 26 | 17 | 43 | 0 | 0 | 43 | 5 |
| 2010 | 3 402 | 374 269 | 21 | 16 | 37 | 2 | 1 | 39 | 8 |
| 2011 | 3 410 | 415 323 | 22 | 24 | 46 | 3 | 0 | 49 | 13 |
| 2012 | 3 363 | 399 922 | 22 | 20 | 42 | 12 | 3 | 54 | 22 |
| 2013 | 3 330 | 392 926 | 27 | 16 | 43 | 9 | 3 | 52 | 15 |
| 2014 | 3 272 | 436 314 | 17 | 28 | 45 | 6 | 2 | 51 | 8 |

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 2013/2014

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 | |
| | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 |
| Total | 53 | 53 | 7 | 9 | 46 | 44 | 6 | 11 | 3 | 3 | 3 | 8 | 11 | 11 | 0 | 0 | 11 | 11 |
| Aircraft with MTOM up to 2250 kg | 30 | 16 | 4 | 2 | 26 | 14 | 2 | 2 | 1 | 0 | 1 | 2 | 6 | 5 | 0 | 0 | 6 | 5 |
| Aircraft with MTOM 2250–5700 kg | 1 | 4 | 0 | 0 | 1 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Aircraft with MTOM over 5700 kg | 6 | 8 | 0 | 0 | 0 | 8 | 2 | 4 | 0 | 0 | 2 | 4 | 5 | 5 | 0 | 0 | 5 | 5 |
| Helicopter | 10 | 16 | 2 | 4 | 8 | 12 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Motor gliders and gliders | 5 | 7 | 0 | 2 | 5 | 5 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Balloons and airships | 1 | 2 | 1 | 1 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

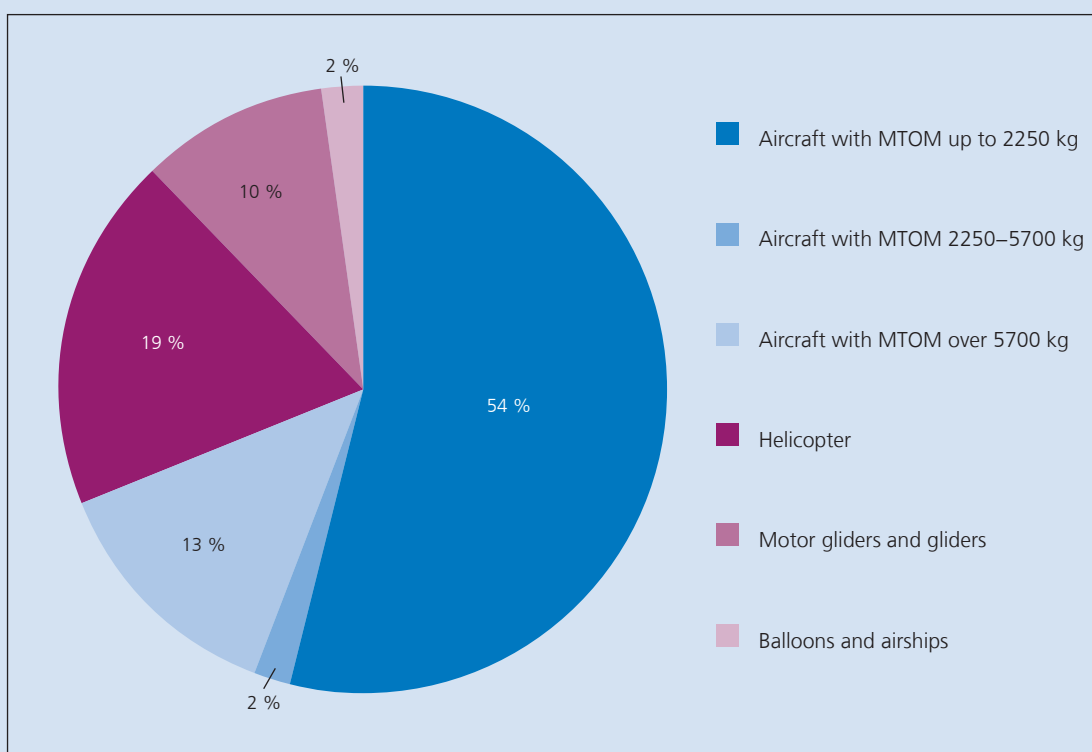
3.2.2 Aircraft inventory and accidents / serious incidents involving Swiss-registered aircraft

| | Number of registered aircraft ¹⁾ (01.01.2015) | | Total number of accidents / serious incidents | |
|----------------------------------|---|------|---|------|
| | 2014 | 2013 | 2014 | 2013 |
| Aircraft with MTOM up to 2250 kg | 1425 | 1458 | 32 | 18 |
| Aircraft with MTOM 2250–5700 kg | 171 | 176 | 1 | 5 |
| Aircraft with MTOM over 5700 kg | 284 | 290 | 8 | 12 |
| Helicopter | 321 | 312 | 11 | 17 |
| Motor gliders and gliders | 978 | 1000 | 6 | 8 |
| Balloons and airships | 377 | 384 | 1 | 4 |
| Total | 3556 | 3620 | 59 | 64 |

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

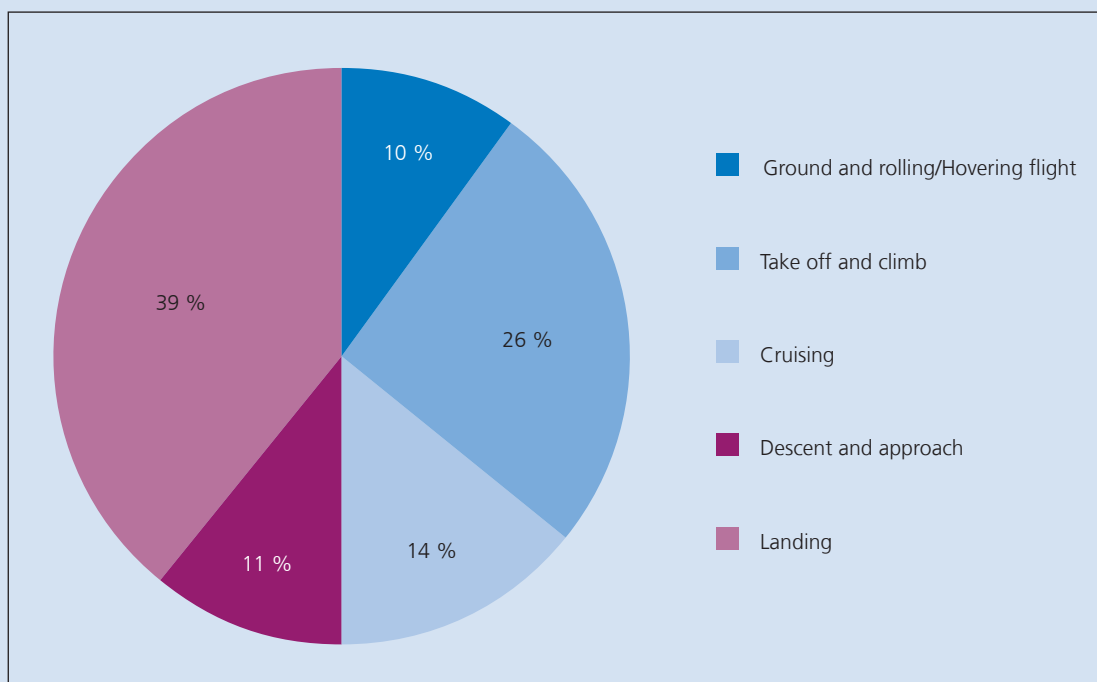
3.2.3 Accidents and serious incidents involving Swiss-registered aircraft according to category of aircraft

| | 2014 | 2013 |
|----------------------------------|------|------|
| Aircraft with MTOM up to 2250 kg | 54 % | 28 % |
| Aircraft with MTOM 2250–5700 kg | 2 % | 8 % |
| Aircraft with MTOM over 5700 kg | 13 % | 19 % |
| Helicopter | 19 % | 27 % |
| Motor gliders and gliders | 10 % | 12 % |
| Balloons and airships | 2 % | 6 % |



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 | |
|----------------------------------|--|------|--------------------|------|----------|------|----------------------|------|---------|------|-------|------|
| | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 |
| Aircraft with MTOM up to 2250 kg | 5 | 0 | 10 | 7 | 2 | 1 | 2 | 3 | 19 | 12 | 38 | 23 |
| Aircraft with MTOM 2250–5700 kg | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 1 | 5 |
| Aircraft with MTOM over 5700 kg | 0 | 1 | 3 | 3 | 3 | 6 | 3 | 5 | 4 | 2 | 13 | 17 |
| Helicopter | 1 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 4 | 11 | 17 |
| Motor gliders and gliders | 0 | 0 | 3 | 2 | 2 | 4 | 0 | 1 | 1 | 2 | 6 | 9 |
| Balloons and airships | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 1 | 4 |
| Total | 7 | 6 | 18 | 15 | 10 | 17 | 8 | 13 | 27 | 24 | 70 | 75 |



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 | |
| | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 |
| Accidents/ Serious incidents | 53 | 53 | 30 | 16 | 1 | 4 | 6 | 8 | 10 | 16 | 5 | 7 | 1 | 2 |
| Deceased | 2 | 14 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 1 | 0 | 1 |
| Crew | 1 | 5 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 |
| Passengers | 1 | 9 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 1 |
| Third persons | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Persons seriously injured | 10 | 12 | 7 | 2 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 1 | 1 | 4 |
| Crew | 4 | 5 | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 1 |
| Passengers | 5 | 7 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 3 |
| Third persons | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 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 | |
| | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 |
| Accidents/ Serious incidents | 6 | 11 | 2 | 2 | 0 | 1 | 2 | 4 | 1 | 1 | 1 | 1 | 0 | 2 |
| Deceased | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 1 | 1 | 0 | 0 |
| Crew | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| Passengers | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| Third persons | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Persons seriously injured | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 |
| Crew | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Passengers | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 |
| 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 | |
| | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 |
| Accidents/ Serious incidents | 11 | 11 | 6 | 5 | 0 | 0 | 5 | 5 | 0 | 0 | 0 | 1 | 0 | 0 |
| Deceased | 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 |
| 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

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1. Tables

1.1 Accidents involving persons and accidents at work

| | 2011 | | | 2012 | | | 2013 | | | 2014 | | |
|---|------------|----|---|------------|----|----|------------|----|---|-----------|----|----|
| Number of reports / call-outs | 324 | | | 373 | | | 379 | | | 382 | | |
| Investigations initiated | 58 | | | 42 | | | 37 | | | 27 | | |
| Accidents involving persons Railways total (not including cableways) | 62 | | | 59 | | | 67 | | | 51 | | |
| Persons injured | † | S | L | † | S | L | † | S | L | † | S | L |
| in a train / tram | – | – | 1 | – | – | 1 | – | – | – | – | 1 | 2 |
| while boarding / alighting | 1 | 6 | 5 | – | – | 6 | – | – | 6 | 1 | 8 | 2 |
| in stations | 7 | 12 | 8 | 9 | 10 | 10 | 9 | 9 | 4 | 11 | 11 | 14 |
| outside stations | 8 | 12 | 2 | 15 | 11 | 4 | 13 | 10 | 5 | 4 | 7 | 4 |
| other | – | – | 2 | – | – | – | – | – | – | 1 | 3 | 1 |
| Suicides* or attempted suicides* reported to STSB | 43* | | | 59* | | | 81* | | | 60 | | |
| Accidents at work | 10 | | | 15 | | | 16 | | | 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

| | 2011 | | | 2012 | | | 2013 | | | 2014 | | |
|--|-----------|---|---|-----------|---|---|-----------|---|----|-----------|---|---|
| Collisions total | 39 | | | 42 | | | 47 | | | 49 | | |
| train-train / tram-tram | 10 / 2 | | | 7 / 0 | | | 6 / 7 | | | 7 / 5 | | |
| with machinery (digger, crane etc.) | 2 | | | 3 | | | 4 | | | 8 | | |
| with buffers | 4 | | | 3 | | | 2 | | | 7 | | |
| with parked vehicles | 3 | | | 6 | | | 7 | | | 3 | | |
| with road vehicles | 14 | | | 20 | | | 14 | | | 13 | | |
| with other things | 4 | | | 3 | | | 7 | | | 6 | | |
| Collisions on level crossings total | 24 | | | 16 | | | 33 | | | 24 | | |
| Persons injured on | † | S | L | † | S | L | † | S | L | † | S | L |
| manned crossings | 1 | 4 | 6 | 1 | 1 | 6 | 4 | 9 | 6 | – | 9 | 4 |
| unmanned crossings | 2 | 3 | 2 | – | 3 | 2 | 2 | 3 | 15 | 3 | 7 | 6 |
| Derailments total | 37 | | | 39 | | | 30 | | | 37 | | |
| passenger train journeys | 4 | | | 6 | | | 4 | | | 5 | | |
| goods train journeys | 3 | | | 2 | | | 2 | | | 2 | | |
| shunting | 22 | | | 19 | | | 20 | | | 21 | | |
| maintenance vehicles | 3 | | | 8 | | | 3 | | | 6 | | |
| trams | 5 | | | 4 | | | 1 | | | 3 | | |

Key to statistics below:

† = Fatalities

S = Severe casualties

L = Minor injuries

1.3 Near accidents, shunting accidents and fire

| | 2011 | 2012 | 2013 | 2014 |
|--------------------------------------|-----------|-----------|-----------|-----------|
| Near accidents / endangerment | 45 | 44 | 47 | 53 |
| Shunting accidents | 6 | 1 | 4 | 6 |
| Fires total | 11 | 20 | 17 | 9 |
| railway vehicles | 8 | 9 | 12 | 4 |
| scheduled buses | 3 | 10 | 5 | 4 |
| cableways | – | 1 | – | – |
| ships | – | – | – | 1 |
| Various | 41 | 47 | 38 | 57 |
| sabotage / vandalism | 4 | 2 | 6 | 7 |
| accidents involving dangerous goods | 3 | 2 | 5 | 3 |
| high-voltage accidents | 6 | 7 | 9 | 14 |
| other | 28 | 36 | 18 | 33 |

1.4 Ship accidents, events involving cableways

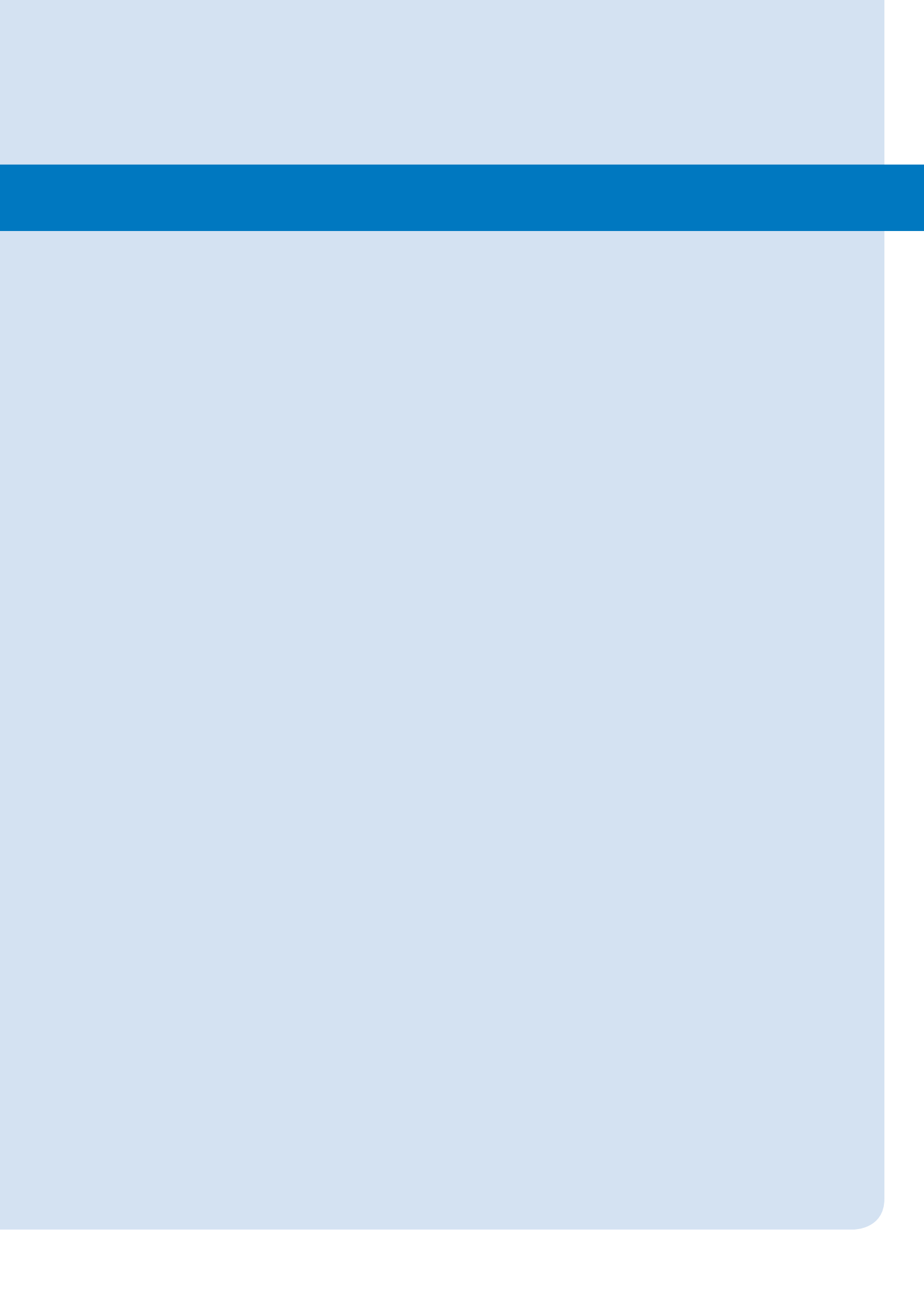
| | 2011 | | | 2012 | | | 2013 | | | 2014 | | |
|--|----------|---|---|----------|---|---|----------|---|---|----------|---|---|
| Ships total | 2 | | | 1 | | | 3 | | | 2 | | |
| Accidents involving persons | 0 | | | 3 | | | 4 | | | 2 | | |
| Cableways total | | | | | | | | | | | | |
| Persons injured in | † | S | L | † | S | L | † | S | L | † | S | L |
| cable cars | – | – | – | – | – | – | – | – | – | – | – | – |
| chairlifts | – | – | – | – | 1 | 2 | 1 | – | 2 | – | – | 2 |
| draglifts | – | – | – | – | – | – | – | – | – | – | – | – |
| Other cableway incidents (not including accidents at work) | 1 | | | 9 | | | 1 | | | 2 | | |
| crash of cabin / chair | – | | | – | | | – | | | – | | |
| deropement | – | | | 2 | | | – | | | 1 | | |
| rope failures | – | | | – | | | – | | | – | | |
| other | 1 | | | 7 | | | 1 | | | 1 | | |

Key to statistics below:

† = Fatalities

S = Severe casualties

L = Minor injuries





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