2015 Runway Safety Report
Zurich Airport
Contents

1. Editorial 3

2. Runway Safety Team Zurich 5
   2.1. Duties and responsibilities of the local Runway Safety Team 5
   2.2. Composition of RSTZ (as at 1 March 2015) 5

3. Runway safety statistics 6
   3.1. Runway incursions 6
      3.1.1. Number of runway incursions 6
      3.1.2. Severity of runway incursions 7
      3.1.3. Types of runway incursions 8
   3.2. Analysis of runway incursions between 2012 and 2014: 9
   3.3. Factors contributing to runway incursions 11
      3.3.1. Number of runway crossings 11
      3.3.2. Frequent changes of radio frequency 11
   3.4. Runway excursions 11

4. Measures for Improving Runway Safety 12
   4.1. Aviation Roadmap, section RWY safety 12
   4.2. Actions from Aviation Roadmap, section RWY safety 13
      4.2.1. Bypass taxiway 28
      4.2.2. EMAS 13
   4.3. Assessment of the effectiveness of actions taken to date 14

5. Outlook 16

Bypass taxiway 28
1. Editorial

With its complex runway layout and many runway crossings, Zurich Airport presents particular operational challenges.

To reduce the number of crossings of runway 28, at the beginning of 2013 Flughafen Zürich AG commissioned planning for a bypass taxiway 28. This project will make a lasting contribution to improving runway safety at Zurich Airport. The work is progressing apace, and a decision on how to proceed is due to be taken during 2015.

The present 2015 Runway Safety Report sets out what runway safety-relevant incidents (runway incursions and runway excursions) occurred at Zurich Airport in the years 2012, 2013 and 2014, how appropriate corrective action was taken, and what further measures are currently planned for the future. This fourth edition of the Runway Safety Report has the following objectives:

1. The provision of data on runway incursions, runway excursions and runway confusions as performance indicators for operations at Zurich Airport

2. The formulation of recommendations for improving runway safety operations at Zurich Airport

3. Promoting awareness among the airport's partners to ensure that the right conclusions are drawn and lessons are learned from incidents.

Stefan Conrad
Chief Operation Officer
Management Board
Flughafen Zürich AG
2. Runway Safety Team Zurich

2.1. Duties and responsibilities of the local Runway Safety Team

The Runway Safety Team Zurich (RSTZ) is a cross-disciplinary team comprising representatives of air traffic control, airlines, GA/BA operators and the airport, and is tasked with initiating and coordinating actions relating to runway safety at Zurich Airport. The RSTZ aims to minimise the number of runway incursions and runway excursions at Zurich Airport.


In concrete terms, the work of the RSTZ includes:

- monitoring the implementation of ICAO standards and recommendations and best practices (ICAO Doc. 9870: Manual on Prevention of Runway Incursions)
- promptly implementing the recommendations of the Eurocontrol Action Plan for the Prevention of Runway Incursions and the Eurocontrol Action Plan for the Prevention of Runway Excursions within a binding timeframe, and monitoring their status every three years
- being informed by the Runway Incursion Investigation Team (RIIT) about all runway incursions and runway excursions at Zurich Airport, and considering any RIIT recommendations
- ensuring that lessons are learned from runway incursions and excursions, taking appropriate action, and notifying all the parties affected
- identifying potential runway safety hazards, drafting proposals for corrective action and lobbying for their implementation
- observing the principles of a "just culture" when evaluating and prescribing measures
- compiling the Zurich Airport Runway Safety Report every three years
- conducting runway safety awareness campaigns for ATC & apron controllers, pilots and vehicle drivers
- in the context of crew resource management (CRM), promoting a shared understanding of runway safety among ATC controllers, pilots, airport operator personnel and any third-party companies involved
- initiating, coordinating and monitoring any multi-company projects relevant to runway safety.

2.2. Composition of RSTZ (as at 1 March 2015)

The local Runway Safety Team currently comprises:

Marc Keusch / Flughafen Zürich AG (FZAG)  Cornelia Huber / skyguide
René Gassner / FZAG  Markus Seger / Swiss
Markus Thommen / Swiss  Claudio Di Palma / skyguide
Marc Rauch / FZAG  Martin Schilt / FOCA
Hansjörg Herzog / Jet Aviation Ltd.  Hansjörg Herzog / Jet Aviation Ltd.
Daniel Hess / Lufthansa  Daniel Hess / Lufthansa
Shaban Shkreli / FZAG  Peter Zahnre / FZAG
Siegfried Ladenbauer / skyguide  Pascal Wegmann / Lufthansa
3. Runway safety statistics

3.1. Runway incursions

3.1.1. Number of runway incursions

NB: The FAA runway incursion rate increased after 2005 because the FAA used the ICAO definition of runway incursion from that year onwards.
3.1.2. Severity of runway incursions

The majority of incidents (15) that occurred at Zurich Airport between 2012 and 2014 were low-risk Category D incidents. Two low-to-medium risk (Category C) incidents occurred during the period; these involved uncontrolled situations to some extent, but they had no further repercussions because no other traffic in the immediate vicinity was involved. There were no medium-to-high risk (Category B) incidents or near misses (Category A) at Zurich Airport during the reporting period. The last Category A incident occurred in 2004. In terms of potential risk, therefore, Zurich Airport has not had any dangerous incidents (Category A and B runway incursions) for over ten years.

Definition according to ICAO Doc. 9870

Cat. C: An incident characterised by ample time and/or distance to avoid a collision.

Cat. D: An incident that meets the definition of runway incursion, but with no immediate safety consequences.
3.1.3. Types of runway incursions

Following the ICAO model, the causes of runway incursions are divided into three main categories (see above). It is important that the causes of every single incident are investigated in detail; following basic classification of these incidents as pilot deviation (flight crew), vehicle/pedestrian deviation or operational deviation (ANSP / Apron Control), it can be seen that the relative ratios of these three main categories have remained approximately the same over the last three years. Note that there are incidents classified as pedestrian deviation which, although they fall under the definition of a runway incursion, essentially have nothing to do with runway safety per se and could just as easily be described as random violations of the protected area (e.g. cyclist or person fleeing in an emergency situation). The categories of pilot deviation and
operational deviation account for a small proportion of the total number of incidents, but they are typically classified as higher risk in individual cases. In comparison with other European airports (ESRA area), the proportion of runway incursions categorised as pedestrian/vehicle deviations is slightly higher.

3.2. Analysis of runway incursions between 2012 and 2014:

- No increase in the number of vehicle/pedestrian category incidents is evident from the incident data for the last three years. One frequent cause of such incidents is a lack of adequate training and routine. The issuing of driving permits must also continue to be monitored closely with respect to inadequate training. With this in mind, the Airport Authority conducted a review of the training modules in 2014.
- A wide range of individuals are implicated as causal factors within the vehicle/pedestrian category: Airfield Maintenance and Airport Authority personnel featured, as well as a cyclist and a person escaping in an emergency situation.
- In the pilot error category, BA/GA aircraft are particularly prone. On average there is one runway incursion by a business jet or a general aviation aircraft per year. A runway safety film has been produced to communicate with this target group of pilots who rarely fly into Zurich. From summer 2015, a mandatory pilot briefing is planned for VFR pilots landing at Zurich.
- Over the three years 2012, 2013 and 2014 covered by the reporting period, there were no incidents in the operational error category.
- Overall, the causes differ widely. It is not possible on the basis of the incidents that occurred during the last three years to identify any systemic safety risks which would be considered unacceptable. Taxiing at Zurich Airport continues to be demanding. It requires good flight preparations, plus a high level of concentration by the tower/ground controllers and the cockpit crew.
- No one particular hot spot has emerged over the last three years. Most runway incursions during 2012, 2013 and 2014 occurred at the RWY 28 holding point; the reasons for this are varied and cannot be attributed to systemic factors.

Circle: Indicates location at which runway incursions have occurred during the reporting period 2012-2014

Number: Number of runway incursions that have occurred at this location during the reporting period 2012-2014
3.3. Factors contributing to runway incursions

3.3.1. Number of runway crossings

Aerodrome design factors such as the number of runway crossings, the position of runway exits and entries, the location of the runways, signs and markings etc. have a major influence on runway incursions. In Zurich, the location of runway 28, between Apron North and Apron South, is also a major factor as this configuration means that taxiing aircraft often have to cross runways. Since the summer of 2010, the number of runway crossings have been counted using SAMAX (Swiss Airport Movement Area Control System) radar data; 120,000 runway crossings per year are recorded at Zurich Airport. Changes to the user concept and their impact on the number of runway crossings are also indicated and analyzed.

3.3.2. Frequent changes of radio frequency

A second key factor is the frequent switching between radio frequencies required at Zurich Airport. Apron North and Apron South (operated by Flughafen Zürich AG) communicate on two different frequencies, as do Ground and Tower (skyguide). As a result, an aircraft landing on runway 14 will need to change radio frequency three times before it reaches the parking position on Apron South. Commencing in December 2013 an attempt was made using an Autonomous Frequency Change ("silent handover") procedure to reduce the TWR frequency load. However, since this resulted in new risks for Apron Control, the procedure had to be withdrawn again from 8 January 2015. An aircraft taxiing from Apron South to take off on runway 16 will also need to make as many frequency changes. These frequency changes continue to demand the attention of cockpit crews, but they are unavoidable due to the interfaces, the geographical configuration and other operational factors (de-icing pads, pushback E19 etc.).

3.4. Runway excursions

In addition to preventing runway incursions, the local Runway Safety Team at Zurich Airport also deals with any runway excursions. As a result of the Tailwind study conducted during the last two years, various measures have already been implemented (e.g. use of thrust reverse on wet runways, verifying the communication of wind information), and others are still under consideration.

One runway excursion occurred at Zurich Airport in the 2012-2014 period. The incident occurred on 26 December 2012 when an aircraft was taxiing off runway 34 on taxiway E6. The Saab 340 came off the runway and the aircraft’s left main landing gear rolled onto the grass. There were no casualties, SAIB (Swiss Accident Investigation Board) did not launch an investigation, the incident was investigated internally by the Safety Office of Flughafen Zürich AG; the two recommendations concerned issues that the business aviation operator had to review.
4. Measures for improving runway safety

4.1. Aviation Roadmap, section RWY safety

Below is an overview of the action already taken and the measures still to be considered for improving runway safety at Zurich Airport. These are intended to reduce the number of runway incursions and runway excursions. The status of these measures is reviewed by the Runway Safety Team Zurich every three years. Where necessary they are adapted and added to the cross-company aviation roadmap.

**Actions taken since 2008 Runway Safety Report:**

- Definition and implementation of Protected Area
- Improvement of Echo South TWY markings (road markings)
- Implementation of coherent red stop bar policy (incl. vehicles)
- Revision of stop bar process instruction
- Red stop bars provided at all runway entries (except TWY A holding point for departures on runway 28 when VMC approaches are in use)
- Creation of runway incursion database / led by Runway Incursion Investigation Team
- RIMCAS Level II: operational since May 2010
- RAAS: installed on some SWISS aircraft since 2009
- ROPS on A380 aircraft

**Actions taken since 2011 Runway Safety Report (spring 2011):**

- Simplicity of RWY 28 holding point
- Harmonisation of stop bars (consolidating Cat. I/II/III on runway 16/34)
- Differentiation between aircraft and vehicles in RIMCAS since the beginning of 2012
- Equipping of pushback tractors with VeeLos since the summer of 2014
- New RWY incursion prevention film on Zurich Airport website since the spring of 2014
- Tracking of user concept, especially impact on the number of runway crossings
- Comparison of documentation against actual situation (AIP, JEPPSEEN, LIDO)
- CRM courses between skyguide ATCO and Apron Control (ZRH Airport TRM)
- Findings of the Tailwind study have been available since the end of 2014
- Implementation of AMDT10 at Zurich Airport; enhanced TWY-CL & mandatory markings

**Actions still to be considered:**

<table>
<thead>
<tr>
<th>Actions still to be considered:</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption of &quot;one runway – one frequency – one language&quot;</td>
<td>Not being pursued further by Zurich Airport; currently pending with FOCA</td>
</tr>
<tr>
<td>Consideration of installing a de-icing pad south of runway 28</td>
<td>Feasibility was demonstrated, more detailed exploration underway</td>
</tr>
<tr>
<td>Clarification of the boundaries of manoeuvring area</td>
<td>The &quot;Apron TWY Steering Group&quot; project group assessed the responsibilities and interfaces from the point of view of safety aspects. On this basis, the status quo will be tolerated by FOCA for the time being.</td>
</tr>
<tr>
<td>Shift of departures from runway 34 to runway 32 for long-haul aircraft from dock E</td>
<td>Already implemented for A380; revision for four-engine aircraft submitted to FOCA for approval as part of the 2014 Operating Regulations</td>
</tr>
<tr>
<td>Surface Manager for routing &amp; guidance (previously Active Taxi Guidance System)</td>
<td>Development of an appropriate concept for a SMAN will be initiated in 2015. The routing function must be implemented by the end of 2023 as part of the SESAR deployment.</td>
</tr>
<tr>
<td>Conflicting Clearances &amp; Conformance Monitoring (Airport Safety Nets)</td>
<td>As part of the SESAR deployment, these safety nets must be implemented by the end of 2020.</td>
</tr>
<tr>
<td>Runway status lights</td>
<td>Not currently possible in Zurich (2013/14 feasibility study), testing and validation will be continued in Paris CDG under the auspices of SESAR.</td>
</tr>
<tr>
<td>ARSI (Automated Runway Status Indication) PIVIS (Pilots' Visualization)</td>
<td>Implementation project planned from 2015 (subject to approval from the Zurich Airport Coordination Group KFFZ)</td>
</tr>
<tr>
<td>Harmonisation of stop bars (consolidating Cat. I/II/III on runway 14/32)</td>
<td>Implementation project planned for 2015</td>
</tr>
<tr>
<td>Use of LEDs / replacement of ground light system</td>
<td>Concept phase, replacement of ground lights by 2019, decision regarding LEDs open</td>
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4.2. Actions from Aviation Roadmap, section RWY safety

Two measures intended to help further improve the runway safety of the airport system are described in detail below. These measures should make a significant contribution to reducing, or even entirely preventing, runway incursions and runway excursions.

4.2.1. Bypass taxiway 28

The risk analysis carried out as part of the "Zurich Airport Runway 28 Optimisation " project indicated that the main risk for landings on runway 28 is taxiing aircraft crossing the runway. At the beginning of 2013, Flughafen Zürich AG therefore commissioned planning for a bypass taxiway 10/28. This would significantly reduce the number of runway crossings, which would substantially and cost-efficiently mitigate the risk of serious accidents.

Planning for the bypass taxiway 28 is being progressed irrespective of further developments in relation to the treaty with Germany. The taxiway will deliver a safety gain not only for the East Concept, but also for the predominantly used northern approach concept, so the risk will be mitigated for both these operating concepts. This project will make a lasting contribution to improving runway safety at Zurich Airport. A decision on how to proceed is due to be taken during 2015.

4.2.2. EMAS

With a length of 90 m behind the runway strip, the RESA (Runway End Safety Area) at the end of runway 28 in Zurich meets the standard required by the International Civil Aviation Organization (ICAO), but not its recommended length of 240 m (see ICAO Annex 14). With the installation of an EMAS (Engineered Material Arresting System), the requirements of the ICAO can be met without extending the RESA to the recommended length.
EMAS is a safety system that is installed at the end of a runway to bring commercial aircraft that overrun the runway to a halt in a safe and reliable manner. The material properties and the system are designed in such a way that they provide optimum braking resistance, while at the same time minimising the risk of damage to the aircraft and/or injury to passengers and crew. As a result, the extent of damage caused by an accident can be reduced, but a runway excursion as such cannot be prevented.

Planning for the installation of an EMAS at the end of runway 28 is underway. It is scheduled to become operational at the end of 2016.

4.3. Assessment of the effectiveness of actions taken to date

Most of the measures to prevent runway incursions that have been taken to date are aimed at raising awareness of the stop bars as a final safeguard before the active runway is reached. In order to ensure consistency, the stop bars for the runways were harmonised between 2010 and 2014 so that there is now only a single stop bar prior to a runway (see photo on page 4). In addition, since 2010 there has been a clearly defined Protected Area. Thanks to this, there is now a consistent approach to safeguarding the runways from aircraft, vehicles and pedestrians. ATC controllers at Zurich Airport use RIMCAS (Level II) as an additional safety net for ensuring safe runway operations. In addition to these infrastructural and technical installations, major efforts have also been made in recent years to raise general awareness. Tailored to specific target groups, flyer campaigns were conducted, a new runway safety film was produced, and it was constantly monitored whether actual practice matched up with AIP charts. The latter included a specific review of LIDO and JEPPESEN charts by the responsible Area Managers of the air transport operators. As well as the CRM courses run between skyguide, FZAG and SWISS, tailored CRM courses (TRM) were run jointly for skyguide's Air Traffic Controllers and Flughafen Zürich AG's apron controllers.

Further measures, such as adopting the "one runway – one frequency – one language" policy and installing alert beacons, have been considered by the Zurich Runway Safety Team, but the decision was taken not to pursue them further at Zurich Airport.

Looking at the runway incursions that have occurred over the last three years, it can be seen that vehicle drivers and pedestrians continue to be involved. There were no incidents in which ATC or apron controllers were involved. The measures set out above should consequently also be targeted at vehicle drivers and pedestrians. However, this target group is a very heterogeneous one, so specific measures need to be taken on a case-by-case basis and depending on the units involved. Here, too, efforts to raise awareness and improve training should be constantly renewed. In conclusion, it can be affirmed that the measures currently in place have made a valuable contribution to preventing runway incursions. Thanks to the action taken and the efforts of all the various stakeholders, not a single Category A or B runway incursion has occurred at Zurich Airport since 2004. Nevertheless, every single case must still be individually investigated, and any actions deemed necessary in response to such incidents and within the broader context of the overall airport system must be taken.

If greater use is to be made of runway 28 in future, particular attention should be paid to the risk of runway excursions. For safety reasons, it must be possible to assign the optimum runway for the prevailing conditions at all times. However, in some circumstances, this requires more changes to approach routes and cannot easily be changed with the existing operating concepts. In this regard, the Tailwind study showed the risks with respect to tailwinds on runways 28 and 14, as well as what mitigation measures are practicable and are to be pursued further on the basis of ALARP (as low as reasonably practicable).

The risk analysis carried out as part of the "Zurich Airport Runway 28 Optimisation" project indicated that the main risk for landings on runway 28 is a collision with a taxiing aircraft crossing the runway. At the beginning of 2013, Flughafen Zürich AG therefore commissioned planning for a bypass taxiway 28. This would significantly
reduce the number of runway crossings, which would substantially and cost-efficiently mitigate the risk of serious incidents. This project will make a lasting contribution to improving runway safety at Zurich Airport. It has to be said that due to the bypass taxiway 28 new threats can arise. With the help of an overall safety assessment those new threats and associated risks will be identified and adequately evaluated. A decision on how to proceed is due to be taken during 2015.

With respect to the crossing runway operation 16/28, further discussions and research are necessary; as well as the technical options (Runway Status Lights = additional safety nets) or ARSI (Automated Runway Status Indication = additional supporting tool), operational restrictions must be assessed in detail on the basis of tests in order to take account of the interests of all stakeholders and preserve a consistent overall viewpoint.
5. Outlook

As well as reviewing the EAPPRI Report 2.0, over the coming years the local Runway Safety Team will be looking at the medium-term issues with respect to runway 28 operation, the ongoing tracking of the user concept (process), and their ramifications, and will be developing infrastructural improvements, particularly in relation to the crossing runway operation and technical modifications.

Particular attention should be paid to the risk of runway excursions at Zurich Airport, especially if greater use is to be made of runway 28 in future. The measures proposed by the Tailwind study jointly conducted with skyguide, Meteo CH and SWISS will be progressed. With a view to reducing any damage resulting from an incident, as mentioned in section 4.2.2, the installation of an EMAS is scheduled for the autumn of 2016.

No urgent action is required at the present time. The measures already planned and discussed will be progressed. The responsible entities are aware of the existing risks in connection with runway safety and appropriate mitigation measures on the basis of the ALARP principle are already in place. Despite the airport's complex layout and the high operational expectations of its users, flight operations can be run safely at Zurich Airport, with the central focus on runway safety. New systems and operational modifications will also continue to be analysed by the respective bodies, such as the Airside Systems & Operations Working Group, the Taxiway Designation Working Group and the local Runway Safety Team.
Bypass taxiway 28