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(Runway excursion - CEFA Aviation (cefa-aviation.com))

Safety Newsletter

saerco
the safe way

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A runway excursion occurs when an aircraft departs the runway in use during the take-off or landing run. The excursion may be intentional or unintentional (extraordinary situation), as the result of an evasive action. They are considered to be the most frequent accident in the landing phase.

Runway excursions may differentiate depending on where the aircraft exits the runway (laterally or at the end). There are times when a runway excursion occurs due to the fact an aircraft landing or taking off exits at the side of the runway, a circumstance that can be due to multiple factors, for example, any of the following:

-inappropriate aircraft handling technique;

-cross-sectional wind component;

-aircraft system malfunction;

-loss of control due to the presence of contaminants on the runway.

Also, there are times when a runway excursion happens since a departing aircraft fails to get airborne before the end of the runway due to:

-inappropriate aircraft handling technique;

-decision to reject a take off at a speed exceeding V1;

-aircraft weight exceeds MTOW (Maximun Take-Off Weight);

-reported runway conditions differing from actual conditions;

-aircraft weight and/or trim used for setting thrust/power or pitch trim position is wrong;

-aircraft system malfunction.

Runway excursion - Wikipedia

Other times, runway excursion occurs when a landing aircraft is unable to stop before end of runway due to:

-incorrect aircraft landing configuration;

-threshold crossing height is too high and/or the touchdown point is beyond the normal touch down zone;

-excess energy on approach;

-cross-sectional wind component;

-tailwind component or abrupt changes in wind direction;

-braking system malfunctioning, such as airbrakes, reverse, tires braking...;

-loss of control due to the presence of contaminants on the runway;

-the need to make an emergency landing due to multiple factors.

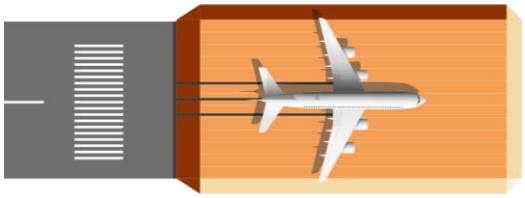
In conclusion, many factors can influence the occurrence of a runway excursion.

mitigation of runway excursions

A key aspect to mitigate the effects of runway excursion on aircraft is to provide sufficient length and width at runway ends to provide a certain margin of safety for aircrafts to operate at a given airport. The dimensions of these areas depend on the certification of each airport according to the reference code considered in ICAO **Annex 14**. Currently, the most widespread mitigation measures are those related to the implementation and maintenance of RESAs and EMAS. These zones are used for overrun runway excursions, i.e., aircraft exits the runway at the end. For the implementation of RESAs and EMAS it is necessary to analyze what space is available and what possible activity there is in these areas near the runway end.

Proper Planning Essential to Mitigating Runway Excursions | NBAA - National Business Aviation Association

RESA (Runway End Safety Area) A symmetrical area over the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aircraft undershooting or overrunning the runway. It extends up to 90 meters from the end of the strip, although it is recommended that when possible it should be extended up to 240 meters.



Runway Safety - Runwaysafe

The RESA also provides greater accessibility to rescue and firefighting teams during these incidents. One of the main disadvantages is that aircraft that exits the runway do not always do so at a relatively low speed, and may exit the runway at such a high speed that they exceed any safety zone. The following mitigation measure takes action upon this possibility.

EMAS (Engineered Materials Arresting System) A surface specially installed which quickly stops any aircraft that moves onto it. EMAS may be installed at the end of some runways to reduce the extent, and associated risks, of any overrun at the end of the runway compared to the equivalent soft ground distance. It may be an alternative to a Runway End Safety Area (RESA) where the topography precludes the full recommended length of a RESA or it may be used in addition to a full length RESA where precipitous terrain immediately follows the end of the RESA.

EMASMAX - the premanufactured EMAS block system (runwaysafe.com)

Their high economic cost due to the materials they are made of, as well as the risk of possible damage to the aircraft by affecting the landing gear and the lower part of the aircraft are the main disadvantages for their installation. The **levelling of the terrain and of manholes, and the frangibility of the necessary navigation systems**, all in accordance with the applicable technical standards, are elements that mitigate the worst credible effects of a runway excursion to the side of the runway.

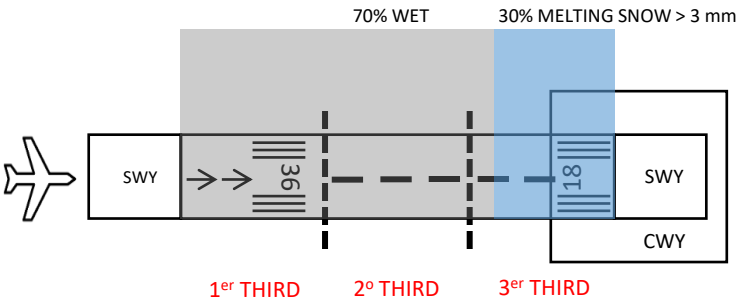
runway condition report

There is not a quite low amount of runway events investigations that has identified some deficiencies in the information about the conditions of the runway's surface that may have contributed while braking inefficiently, being a causal factor or contributive in some runway excursion.

Purposely, answering these type of deficiencies arises the Runway Condition Report (RCR). It's a reporting mode included in the Global Reporting Format (GRF) and ICAO establish a worldwide notification formula about the state of the runway.
The Runway Condition Report permits the use of a system that enables the evaluation and notification to operators about the status of the aerodrome's pavement and the posible presence of polluting elements that afect the aircrafts' performances being water, ice, snow or frost so that the information may be directly applicable in the decisions about different aircraft's action on the runway. These reports are notified through AIS and ATS services in RCR/SNOWTAM format, and that shall not lead to the thought that is subject exclusively to the presence of ice, but to multiple meteorologic conditions. The basic content that should have exist a report of these features, founded in the Runway Condition Code (RWYCC), through which is informed about the status of the runway, stimulating a good situational awareness and that contributes properly in the decision making during the braking phase. The evaluation of the runway status will be made with a runway condition evaluation matrix,

EADD 02170345 09C 2/3/3 75/100/100 06/12/12 SLUSH/WET SNOW/WET SNOW 35

the Runway Condition Assessment Matrix (RCAM), for the crew communication about the braking efficiency. After the first runway state evaluation, a first RCR is being generated. And if the rainfall continues, a successive inform must be created with the purpose of showing posible changes that may suffer the RCR report.
After landing, the crew itself is in charge of making a report or Pilot Report (PIREP) about the braking efficacy on runway based on the performance through the description criteria in order to reduce the RCR key.



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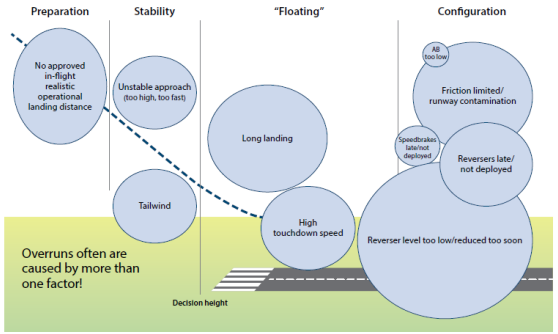
According to ICAO, runway excursions are a persistent problem that has not been reduced in more than 20 years and requires actions by the entire industry to prevent their occurrence and mitigate their effects. To this end, the European Action Plan for the Prevention of Runway Excursions (EAPPRE) was born in 2013, a document published by EUROCONTROL and whose main purpose is to establish a series of recommendations aimed at preventing this type of incident, as well as guidance material for its implementation by the different organizations involved in daily operations (airport managers, air navigation service providers, operators and manufacturers, among others), in order to reduce the rate of runway excursions in general. EAPPRE is structured in two main parts: the first contains a series of recommendations, and the second contains guidance materials for the different actors involved in daily operations.

Later, in 2021, the Global Action Plan for the Prevention of Runway Excursions (GAPPRE) document is published by EUROCONTROL with the collaboration of EASA and the Flight Safety Foundation, and is considered as the natural evolution of EAPPRE. GAPPRE has a similar structure to its predecessor, also with a part containing recommendations with an indicative implementation date and a second part containing reference guidance material.



This second part is quite descriptive, in the sense that it includes a series of aspects related to each of the recommendations in which it sets out why it should be implemented, what the organization can do to implement the recommendation, and how to do it, including references.

to guidance material that elaborates on what is presented in the document, as well as examples to support the argumentation.

VALIDATED BY

COORDINATED BY

Global Action Plan for the Prevention of Runway Excursions

Part 1 - Recommendations
Part 2 - Guidance and Explanatory Material

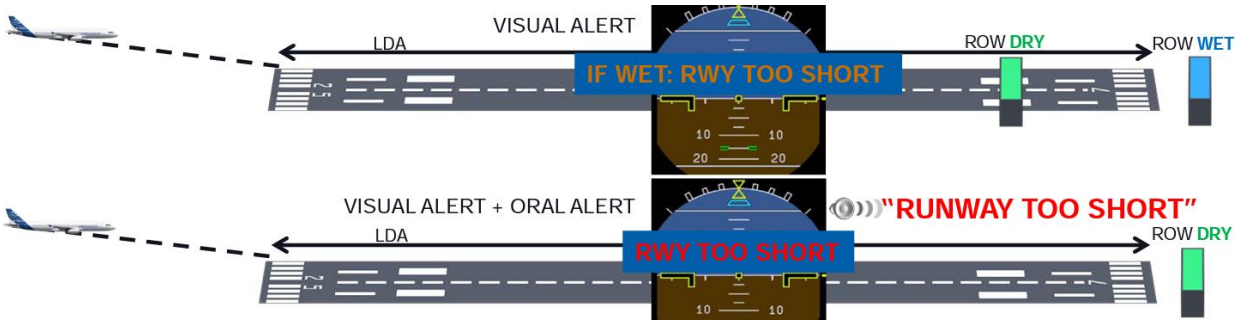
These recommendations are not mandatory, and it is up to the responsible organizations to decide on their adoption taking into account local conditions and context, although their implementation is the result of industry consensus after years of work on the analysis of incidents of this type. It is possible that some of them can be implemented immediately, but others will require much more time, as well as the availability of technology.

https://www.eurocontrol.int/news/eurocontrol-and-partners-issue-recommendations-prevent-runway-excursions

runway overrun prevention system

The aircraft manufacturers are not staying behind to prevent runway excursions. The Runway Overrun Prevention System, ROPS designed by AIRBUS to perform continous calculations in order to verify the remaining runway distance. If that remaining distance is not enough, to proceed to activate applicable procedures and systems to assist the crew upon the decisions that must be taken.

ROPS is an avionic integration Airbus system which have access to different parameters that affect the aircraft stopping distance; in addition, it is connected to a database whose source is Terrain and Warning System (TAWS) or the Onboard Airport Navigation System (OANS), with the necesary information regarding the runways, including declared distances such as TORA, TODA, ASDA and LDA.



Runway End Overrun Warning, during Air Phase

This system is designed to have two main functions:

- The Runway Overrun Warning (ROW) activates from 500 ft and remains active until short-final. Its operation is based on the In-Flight Landing Distances principle. It is continously calculating two distances, the wet runway stopping distance (DRY), and the wet runway stopping distance (WET). Besides, it alerts to the crew in case that the stopping distance is greater than the available stopping distance generating messages that are presented to pilots in the artificial horizont, as the imagen above.
- Once the aircraft has landed, the Runway Overrun Protection (ROP) activates calculating the distance until the taxi speed is reached. If the system detects a risk of runway excursion, a red alert jumps out showing *"MAX BRAKING, MAX REVERSE"*. Is a reversible system that can be cancelled when the risk of excursions disappears.

In aircrafts such as the A380 and the A350, the ROP system is integrated in the FMS and their navigation systems, and presents in a displau graphically and up-to-time the stopping zone in wet and dry runway conditions.

lessonslearned:
Incidents related to runway excursions

B744, Halifax NS Canada, 2018

On 7 November 2018, a Boeing 747-400F overran wet landing runway 14 at Halifax at night and was sufficiently damaged as a result of exceeding the available RESA to render it a hull loss.

B744, Halifax NS Canada, 2018 | SKYbrary Aviation Safety

B744, Maastricht-Aachen Netherlands, 2017

On 11 November 2017, a 747-400ERF crew making a night rolling takeoff at Maastricht-Aachen lost aircraft directional control after an outer engine suddenly failed at low speed and a veer-off onto soft ground adjacent to the runway followed.

B744, Maastricht-Aachen Netherlands, 2017 | SKYbrary Aviation Safety

B738, Kingston Jamaica, 2009

On 22 December 2009, the flight crew of an American Airlines Boeing 737-800 made a long landing at Kingston at night in heavy rain and with a significant tailwind component and their aircraft overran the end of the runway at speed and was destroyed beyond repair. There was no post-crash fire and no fatalities, but serious injuries were sustained by 14 of the 154 occupants. The accident was attributed almost entirely to various actions and inactions of the crew. Damage to the aircraft after the overrun was exacerbated by the absence of a RESA.

B738, Kingston Jamaica, 2009 | SKYbrary Aviation Safety

B738, Calicut (Kozhikode) India, 2020

On 7 August 2020, a Boeing 737-800 making its second attempt to land at Calicut off a night ILS approach with a significant tailwind component became unstabilised and touched down approximately half way down the 2,700 metre-long wet table top runway and departed the end of it at 85 knots before continuing through the RESA and a fence and then dropping sharply onto a road.

B738, Calicut (Kozhikode) India, 2020 | SKYbrary Aviation Safety

CRJ2, Charleston WV USA, 2010

On 19 January 2010, PSA Airlines CRJ 200 began take off from Charleston with an incorrect flap setting. After late crew recognition, a rejected take off was commenced at V1+13Kt IAS and an overrun into the EMAS bed at approximately 50knots followed.

CRJ2, Charleston WV USA, 2010 | SKYbrary Aviation Safety

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