Technical report
A-020/2021

Accident involving a Boeing 737-8AS aircraft, registration EI-EGA, on 12 May 2021 at Alicante Airport (Alicante, Spain)

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GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA
UNDERSECRETARIAT
CIVIL AVIATION
ACCIDENT AND INCIDENT
INVESTIGATION COMMISSION

Notice

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC) regarding the circumstances of the accident and its causes and consequences.

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.6 of Regulation (UE) nº 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1 and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report was originally issued in Spanish. This English translation is provided for information purposes only.

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ABBREVIATIONS

° ' "	Sexagesimal degrees, minutes and seconds
°C	Degrees Celsius
%	Per cent
AAIB	Air Accidents Investigation Branch of the United Kingdom
AAIU	Air Accidents Investigation Unit of Belgium
AC	Assessment circular
AENOR	The Spanish Association for Standardisation and Certification
AMC	Acceptable Means of Compliance
ARP	Aerospace Recommended Practice
ATPL(A)	Airline transport pilot license (aircraft)
cm	Centimetres
CPL(A)	Commercial pilot license (aircraft)
DAR	Detachable integrated airstairs rail
DUE	University Nursing Diploma
EASA	European Aviation Safety Agency
ESGG	ICAO code for Gothenburg Airport
FAA	United States Federal Aviation Administration
FAR	Federal aviation regulations
h	Hours
hPa	Hectopascals
IFR	Instrumental flight rules
kg	Kilogrammes
km	Kilometres
kt	Knots
LEAL	ICAO code for Alicante Airport
m	Metres
METAR	Aviation routine weather report (in aeronautical meteorological code)
NTSB	United States National Transportation Safety Board
ICAO	International Civil Aviation Organisation
QNH	Altimeter setting to obtain elevation above sea level when on the ground
SAE	Society of Automotive Engineers
SAIB	Special Airworthiness Information Bulletin
SB	Service Bulletin
UNE	A Spanish standard
UTC	Coordinated universal time

Technical report

A-020/2021

Operator	Ryanair Designated Activity Company
Aircraft:	Boeing 737-8AS, registration EI-EGA (Ireland)
Date and time of accident:	12 May 2021: 23:30 h[1]
Site of accident:	Alicante Airport (Alicante)
Persons on board:	6 (crew members), 162 (passengers)
Type of flight:	Commercial air transport - Scheduled - International - With passengers
Phase of flight:	-
Type of operation:	IFR
Date of approval:	26 January 2022

Synopsis

Summary:

On Wednesday, 12 May 2021, the Boeing 737-8AS aircraft, with registration EI-EGA, had departed from Gothenburg Airport (ESGG), landed at Alicante Airport (LEAL), and was parked on stand 16 of the apron. At approximately 23:30 h, the passengers began to disembark via the aircraft's forward stairs. While disembarking, one of the passengers got one of the two suitcases he was carrying caught on the stairs and lost his balance. Being unable to grab the handrail, he fell from the top of the stairs and hit another passenger at the bottom of the stairs. The passenger who fell sustained serious injuries.

The crew stopped the disembarkation via the forward stairs and redirected the rest of the passengers towards the rear exit of the aircraft.

The ground personnel immediately assisted the injured passenger, and the dispatcher called for an ambulance, which took approximately 10 minutes to arrive and transferred the wounded passenger to hospital. At the hospital, the injured passenger received stitches to his head, and it was confirmed that he had broken his arm.

After the accident that is the subject of this report, there were 3 further instances of passengers falling while disembarking via the forward stairs of Boeing 737 aircraft operated by Ryanair in Spain. One of them occurred on 13 June 2021 at Málaga Airport and is being investigated by the CIAIAC (reference A-025/2021) due to the severity of the passenger's injuries. The other two both occurred on 16 July 2021, one

[1] All times used in this report are local time. The UTC is 2 hours less.

at Málaga Airport and one at Valencia Airport, but neither met the criteria to be considered an accident or serious incident, under Regulation (EU) 996/2010. It is recommended that this report be read in conjunction with report A-025/2021 for a clearer understanding of the event.

The investigation has determined that the cause of the accident was the passenger's decision to disregard the disembarkation instructions and descend the stairs with one suitcase in each hand.

The stairs are approximately 0.62 m^2 wide, which is sufficient for passengers to carry a single suitcase. However, as was shown in this case, it may not be enough to carry two suitcases, especially if they are separated a certain distance from the body.

Moreover, anyone carrying two suitcases would be unable to grasp the handrail should they lose their balance.

We have, therefore, found it necessary to issue two safety recommendations concerning modifications to the disembarkation procedure to the operator.

[2] The central aisle of these aircraft is 0.60 m wide; which, is considered sufficient to allow one person to walk along it.

1. THE FACTS OF THE INCIDENT

1.1. Overview of the accident

On Wednesday, 12 May 2021, the Boeing 737-8AS aircraft with registration EI-EGA flew from Gothenburg Airport (ESGG) to Alicante Airport (LEAL). As its passengers were disembarking, one of them fell down the stairs and was seriously injured.

The passenger was treated by the airport medical services and taken by ambulance to hospital.

1.2. Injuries to persons

Injuries	**Crew**	**Passengers**	**Total in the aircraft**	**Others**
Fatal				
Serious		1	1	
Minor				
Unharmed	6	161	167	
TOTAL	6[3]	162	168	

1.3. Damage to the aircraft

The aircraft did not sustain any damage.

1.4. Other damage

There was no additional damage.

1.5. Personnel information

1.5.1. Information about the crew

The 30-year-old captain had an airline transport pilot license for aeroplanes-ATPL (A)-, issued on 08 June 2015, with a B737 300-900 rating valid until 31 December 2021. His class 1 medical certificate was valid until 13 December 2021.

The 37-year-old co-pilot had a commercial aircraft pilot license-CPL(A)-, issued on 28 June 2018, with a B737 300-900 rating valid until 31 December 2021. His class 1 medical certificate was valid until 06 October 2021.

1.6. Aircraft information

- Make: Boeing
- Model: 737-8AS

[3] The crew comprised 2 flight crew and 4 cabin crew.

- Year of manufacture: 2009
- Serial number: 38490
- Registration: EI-EGA
- Maximum take-off weight: 66,990 Kg
- Number of engines: 2
- Type of engines: CFM56-7B
- Information about the owner and operator: The aircraft has been registered with the Irish Aircraft Registry in the name of Ryanair Designated Activity Company since 13 November 2009.

The aircraft has an Airworthiness Certificate and an Airworthiness Review Certificate, which was valid at the time of the event.

1.6.1. Description of the stairs on the Boeing 737 aircraft

Some Boeing 737 series aircraft, including the aircraft involved in this accident, have retractable stairs on the forward left side of the cabin to allow for the boarding and disembarking of passengers without the need for additional ground support equipment. The stairs have a handrail on each side. These types of stairs have narrower steps and thinner and lighter handrails than the external stairs provided by airport handling services[4].

The following figure, extracted from Boeing's document on "Airplane Characteristics for Airport Planning", shows the dimensions of the stairs. The height of the stairs on the 800 model ranges from a minimum of 1.85 m to a maximum of 2 m, and the length is 3.53 m. Thus, the slope varies between 69% and 62%, respectively. The width of the stairs is approximately 0.62 m.

[4] In Spain, the 15 January 2014 resolution of the Directorate-General for Industry and Small and Medium Enterprises contains the UNE standards approved by AENOR. Among them is standard UNE-EN 12312-1: 2013 entitled "Ground equipment for aircraft. Specific requirements. Part 1: Passenger stairs".

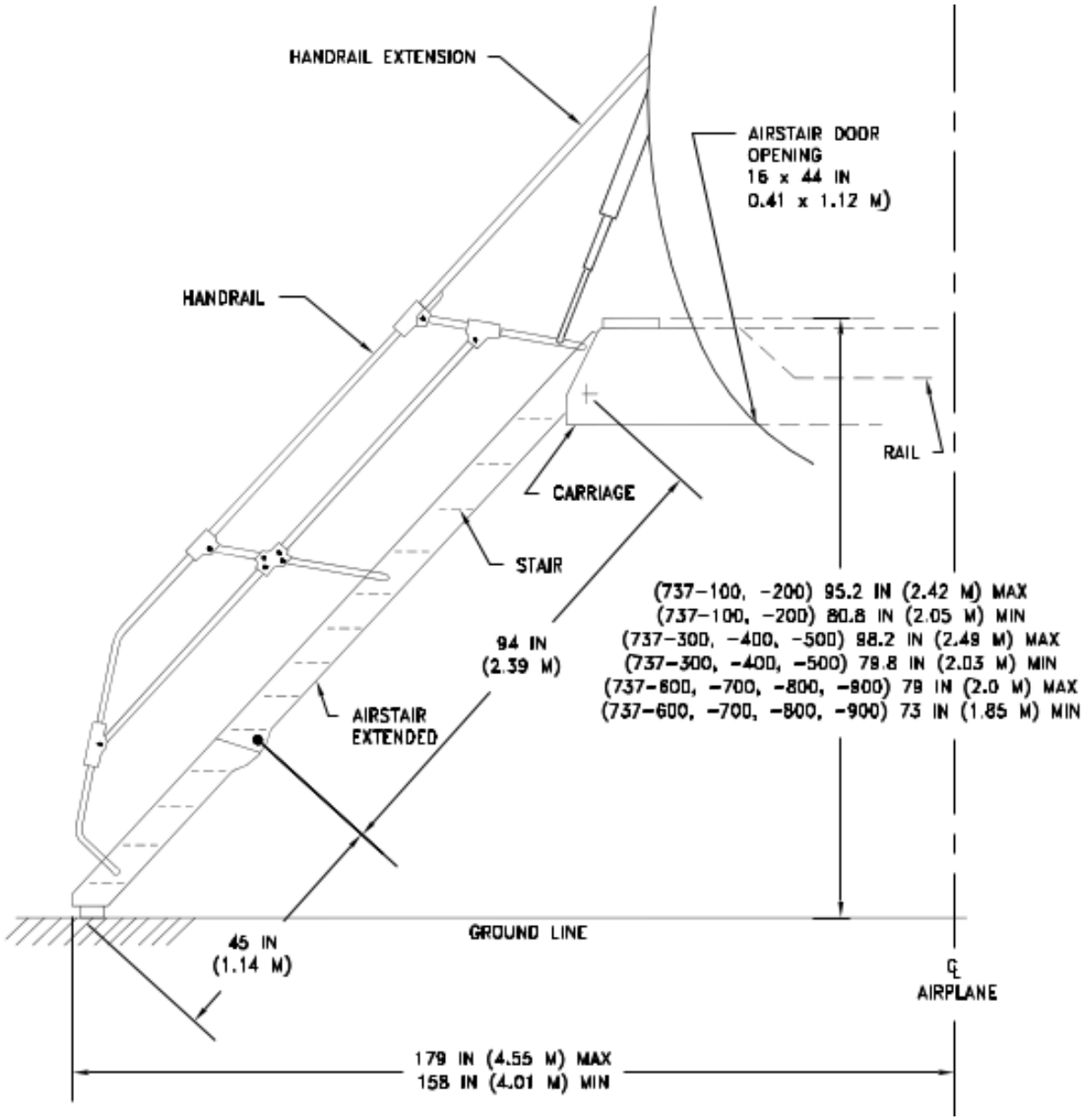
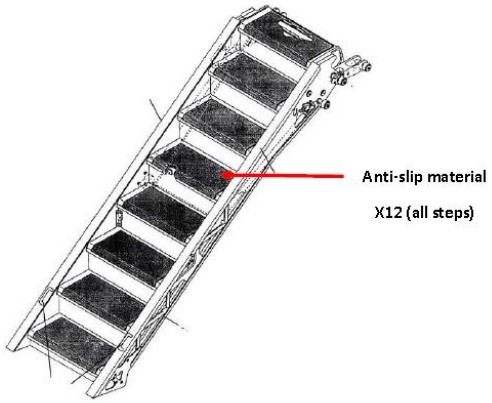


Illustration 1: Dimensions of the stairs on the Boeing 737 aircraft

Over the years, Ryanair has installed several additional safety measures on the integrated stairs of its Boeing 737 aircraft to reduce the risk of passengers falling, especially young children:

1.- The stair treads are covered with a non-slip material called 3M Safety Walk 710 - Coarse[5]

Although Ryanair's manuals also allow the use of the 3M Safety Walk 610 - General Purpose non-slip material[6], the stairs of the aircraft in question are equipped with the former.



2.- In June 2010, retractable, high-visibility safety barriers were installed at the bottom of the forward Lav A bulkhead and the bottom of the cabin side wall next to and beneath 1ABC, as shown in the images:

3.- In December 2010, the aircraft were fitted with detachable airstairs rails (DAR). These rails provide a safe, visual connection to the integrated handrails. They are attached when passengers board or disembark the aircraft through the forward entrance door (door L1). The ends of the rail are attached to the support strut fixed to the cabin floor at door L1, which holds it in place. The other attaches to the integrated stair rail, providing tension.

4 - The aircraft involved in this event had warning signs advising that passengers travelling with young children should hold their hands when walking up or down the stairs,

[5] The non-slip *3M Safety Walk Coarse Tapes and Treads - 700 Series* material consists of large abrasive particles bonded by a strong and durable polymer to a dimensionally stable plastic film. The reverse side is coated with a pressure-sensitive adhesive covered by a removable protective liner.

[6] The non-slip *3M Safety Walk Coarse Tapes and Treads - 600 Series* material consists of large abrasive particles bonded by a strong and durable polymer to a dimensionally stable plastic film. The reverse side is coated with a pressure-sensitive adhesive covered by a removable protective liner.

as per Special Airworthiness Information Bulletin (SAIB) NM-07-47[7], issued by the FAA in September 2007. The stairs of the aircraft involved in this event are shown in the two photos below. The warning signs are visible on the step risers:

Illustration 2: Detail of the stairs on the Boeing 737-8AS aircraft, with registration EI-EGA

These warning signs also advised holding onto the handrail with the other hand.

The aircraft also had warning signs on the door frames, as can be seen in the following photographs:

[7] https://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSAIB.nsf/0/cab005ca55f1abd78625734e006eb6b7/$FILE/NM-07-47.pdf

Illustration 3: Detail of the signs on the door frames of the Boeing 737-8AS aircraft, with registration EI-EGA

1.7. Meteorological information

It was not raining or windy at the time of disembarkation.

1.8. Aids to navigation

N/A.

1.9. Communications

N/A.

1.10. Aerodrome information

The aircraft landed at Alicante-Elche Airport, whose ICAO code is LEAL. The airport is located 9 km to the southwest of the city of Alicante. Its elevation is 43 metres and it has one 3,000-metre-long by 45-metre-wide runway designated 10/28.

1.11. Flight recorders

N/A.

1.12. Aircraft wreckage and impact information

N/A.

1.13. Medical and pathological information

N/A.

1.14. Fire

Not applicable.

1.15. Survival aspects

The incident was captured by the airport's cameras. However, how the passenger fell is not clear:

Illustration 4: Passenger descending the stairs moments before the fall

According to the airport management company, after the passenger fell, medical assistance was requested at 23:32 h, and the ambulance arrived at the stand at 23:41 h. It, therefore, took 9 minutes to arrive.

The established procedure for the provision of medical assistance at the airport is Aena's medical assistance policy. According to that policy, airports with between 8 million and 20 million passengers, as was the case for Alicante airport in 2018 and 2019 prior to the Covid 19 pandemic, must have a doctor and a permanent ambulance service at all times except for off-peak hours, during which a DUE and a reduced ambulance service will suffice. At the time of the accident, the airport was operating under its summer schedule, which dictates that an on-airport doctor and ambulance must be available to provide medical assistance from 06:00 h to 0:00 h.

1.16. Tests and research

1.16.1. FAA regulations applicable to integrated stairs on commercial air transport aircraft

Part 25 of the Airworthiness Standards: Transport Category Airplanes, the FARs (Federal

Aviation Regulations) prescribed by the FAA (United States Federal Aviation Administration) and applicable to the Boeing 737 aircraft, do not contain any requirements in regard to integrated stairs on commercial air transport aircraft.

However, in September 2007, after four incidents in which small children were injured due to falling down the stairs, the FAA issued Special Airworthiness Information Bulletin (SAIB) NM-07-47 to owners and operators of Boeing 737 aircraft equipped with integrated stairs. It recommended the implementation of the Service Bulletins issued by Boeing, (SB) 737-52-1157, and Monogram System, the stair manufacturer, (SB) 870700-52-2130, which was referred to in the aforementioned Boeing service bulletin. These service bulletins recommend that warning signs advising passengers travelling with young children to hold their hands when climbing or descending the stairs should be placed on the risers of each step and the door frames. They also recommended the installation of anti-slip material on the upper platform and side handrails. Boeing also revised the Flight Attendant Manual, advising that special attention be paid to passengers with special needs or those travelling with young children.

In June 2012, the FAA issued Advisory Circular (AC) 150/5220-21C on boarding equipment used on aircraft. In regard to integrated airstairs, the Circular indicated that they must comply with the requirements of ARP (Aerospace Recommended Practices) 836 issued by the SAE (Society of Automotive Engineers). However, as indicated by Boeing during the investigation, this rule only applies to the external stairs provided by airport handling services and not to the integrated airstairs in Boeing 737 aircraft.

1.16.2. EASA regulations applicable to integrated stairs on commercial air transport aircraft

In its 2009 document, CS-25 Cabin Safety Requirements, EASA addressed the possibility of establishing requirements for integrated airstairs, recommending the following:

> *Recommendation 48 – Recommendation for incorporating industry standards for general occupant safety (e.g. slip, trip and fall prevention) into AMC*
>
> *Whilst many of the slip, trip, and fall accidents inside or from the cabin involved non-compliance with standard operating procedures or complacency, there may be aircraft design features that can reduce its risk. This may be particularly relevant to features like staircases within very large twin-deck aircraft such as the A380. Additionally, there are no regulations governing the height, angle or slip resistance of the steps, or the provision of handrails for integrated airstairs. Industry standards (SAE publications) on these subjects are available. It is recommended that further deliberation be given by EASA to investigate the feasibility of the incorporation of (or referral to) such standards into airworthiness requirements.*

However, the current European regulations contain no requirements in this regard.

1.16.3. Events involving passengers falling on the stairs while boarding or disembarking. Recommendations and safety measures implemented.

In 2010, the CIAIAC investigated accident A-017-2010. While boarding via the forward stairs of a Boeing 737-800, a young girl who was being held by her father fell from the top of the stairs to the ground through the gap between the handrail and the upper platform. Given that the safety recommendations previously issued by the UK's Accident Investigation Authority (Air Accidents Investigation Branch or AAIB)[8] following a similar accident at London Stansted Airport on 17 July 2009 were considered to be sufficient, the CIAIAC did not issue any further safety recommendations in its report. The safety recommendations were:

- That Boeing establish a process to inform the operators of all Boeing commercial aircraft of changes to the relevant Flight Attendants Manual[9].
- That Ryanair review their current passenger boarding and disembarking procedures so that assistance is made available to passengers accompanied by children, and those with special needs.
- That Boeing review the design of the Boeing 737 forward airstairs with the intention of adding a removable barrier to minimise the possibility of a child falling through the gap between the extendable handrail and its upper platform.

In addition to these recommendations, following the accident on 17 July 2009 in London, Ryanair modified its fleet of Boeing 737 aircraft to include a tensioned, high-visibility belt between the door opening and the extendable handrail post and the detachable integrated airstairs rails.

Subsequently, several accidents involving passengers falling down the stairs when boarding or disembarking a Boeing 737 aircraft have occurred. The Accident Investigation Authorities did not consider it necessary to issue further safety recommendations for any of them[10].

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[8]The report can be downloaded from the following link:
https://www.google.es/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwim_MLu3-nwAhVD-qQKHTqJAUIQFjAAegQIBBAD&url=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fmedia%2F5422ef83ed915d137100026b%2FBoeing_737-800__EI-DLJ_08-10.pdf&usg=AOvVaw2b1zHKzsonPlImov13R1OT

[9] This recommendation was issued because Boeing had added the following warning to its Manual without ensuring all operators were informed of the update:
WARNING: As passengers are boarding or deplaning, pay particular attention to persons with small children or those with special needs. Small children on airstairs should be attended by an adult or responsible person.

[10] In 2019, a boy fell from the stairs while disembarking from a Boeing 737 aircraft at London Stansted Airport. The accident was investigated by the AAIB. The report can be downloaded from the following link:
https://www.google.es/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi4oei-4enwAhXD26QKHVR5CI8QFjAAegQIBhAD&url=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile%2F919999%2FAAIB_Bulletin_2-2020_Hi_res.pdf&usg=AOvVaw3lIzi63Xe4J3owSN2mz3cy

1.16.4. Ryanair's disembarkation procedure

Ryanair's procedures stipulate that, before proceeding to disembark the passengers, the following announcement must be made to them:

"Ladies and Gentlemen, you may now disembark the aircraft using both the forward and rear doors. All passengers should use the handrail provided when walking down the stairs. For passengers travelling with children, please hold their hands as you walk down the stairs and until you are inside the terminal building. Walk around the wing and not under the wing. Thank you and good morning/afternoon/evening"

During the investigation, Ryanair indicated that this announcement is made in English.

1.17. Organisational and management information

N/A.

1.18. Additional information

N/A.

1.19. Special investigation techniques

N/A

In its report, the AAIB indicated that it had identified eight events in Europe since 2009, six of them involving children of various ages falling from the stairs of a Boeing 737 aircraft.

In 2020, an accident at Charleroi airport was investigated by the Belgian Accident Investigation Authority (Air Accident Investigation Unit or AAIU). In this case, it was an adult who fell down the stairs while disembarking. The report can be downloaded from the following link: http://www.aaiu.ie/node/1491

2. ANALYSIS

Various aspects of the accident were analysed, including the safety of the integrated airstairs, Ryanair's disembarkation procedure and the passenger's actions while disembarking.

2.1. Analysis of the safety of integrated airstairs on aircraft

The FAA's airworthiness standards applicable to air transport aircraft and, therefore, to the Boeing 737 aircraft do not contain any requirements related to integrated airstairs on commercial air transport aircraft. Nor has EASA deemed it necessary to regulate these types of stairs in its standards.

However, in September 2007, the FAA issued a Special Airworthiness Information Bulletin (SAIB), recommending, among other things, that non-slip material be installed on the upper platform and side handrails of the stairs. The measures recommended by the FAA had been implemented on the aircraft involved in this accident. Furthermore, the stair treads of the aircraft involved in the accident are also covered with a non-slip material, specifically, 3M Safety Walk 710 - Coarse.

In 2010, the aircraft's operator decided to install retractable, high-visibility safety barriers and removable rails on their aircraft to improve the safety of the stairs.

Therefore, we have concluded that the aircraft's operator implemented all the available measures to improve the safety of the integrated stairs installed on its aircraft.

2.2. Analysis of Ryanair's disembarkation procedure

Ryanair's procedures stipulate that, before proceeding to disembark the passengers, the following, among other things, must be communicated to them: *"All passengers should use the handrail provided when walking down the stairs".* This announcement is made in English only. Although the English language is an international language commonly used in aviation, we believe safety could be improved by also making the announcement in the official language of the departure and destination countries. Therefore, we are issuing a safety recommendation to Ryanair.

Furthermore, we believe safety could be improved by reinforcing the disembarkation procedure as follows:

The cabin crew must ensure during the disembarkation procedure that the passengers have one hand free to hold on to the handrail when descending the forward stairs of the aircraft. If the cabin crew see a passenger is about to descend the forward stairs with both hands occupied (for example, carrying two carry-on suitcases, as was the case in this event), they should remind them that they must use the handrail when going down the forward stairs.

2.3. Analysis of the passenger's actions while disembarking

Even though the aircraft has warning signs recommending that passengers hold onto the handrail when walking down the stairs and that before proceeding to disembark the passengers, Ryanair advised them to do the same in a passenger announcement made in English, the injured Swedish passenger descended the stairs while holding two carry-on bags and, therefore, without holding onto the handrail.

Since the forward stairs are approximately 0.62 m-wide and about 60 cm is required to descend comfortably, this space was insufficient. According to the passenger himself, one of the suitcases got stuck on the stairs.

The stuck suitcase caused the passenger to lose his balance. As both hands were holding suitcases, when he lost his balance, he was unable to grasp the handrail to prevent the fall.

3. CONCLUSIONS

3.1. Findings

- The passenger had been informed, in English, about how to use the integrated airstairs safely.
- The FAA's airworthiness standards applicable to air transport aircraft and, therefore, to the Boeing 737 aircraft do not contain any requirements related to integrated airstairs on commercial air transport aircraft.
- The aircraft's operator implemented all the available measures to improve the safety of the integrated stairs installed on its aircraft.
- The passenger descended with a suitcase in each hand.
- The passenger descended without holding onto the handrail of the forward stairs.
- One of the suitcases got stuck on the stairs, and the passenger lost his balance.

3.2. Causes/contributing factors

The investigation has determined that the cause of the accident was the passenger's decision to disregard the disembarkation instructions and descend the stairs with one suitcase in each hand.

At 0.62 m, the width of the stairs is sufficient to allow passengers to hold one suitcase. However, as was shown in this case, it may not be enough to carry two suitcases, especially if they are separated a certain distance from the body.

Moreover, anyone carrying two suitcases would be unable to grasp the handrail should they lose their balance.

4. OPERATIONAL SAFETY RECOMMENDATIONS

REC 01/22: It is recommended that Ryanair modify its disembarkation procedure to provide the warning concerning the use of the handrail when descending the stairs in the official languages of the departure and destination countries, as well as in English.

REC 02/22: It is recommended that Ryanair reinforce its disembarkation procedure to stipulate that if a member of the cabin crew observes a passenger intending to descend the forward stairs without a free hand, they should remind them that they must use the handrail when descending the stairs.