Australian Government

Australian Transport Safety Bureau

Runway overrun involving Fokker 100, VH-NHY

Newman Airport, Western Australia, on 9 January 2020

ATSB Transport Safety Report

Aviation Occurrence Investigation (Defined)

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Addendum

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Safety summary

What happened

On the morning of 9 January 2020, a Fokker 100 registered VH-NHY and operated by Network Aviation conducted a regular public transport service from Perth to Newman, Western Australia.

The weather forecast for Newman Airport included heavy rain, moderate to severe turbulence below 5,000 ft and a 25 kt crosswind. At the time the aircraft departed Perth, Newman Airport had received about 88 mm of rain since 0900 the previous morning.

After a stable approach, the aircraft touched down in moderate rain, at or before the touchdown zone, at a speed 16 kt above the reference landing speed for the configuration. The crosswind at the time was recorded as gusting to 35 kt. The flight crew experienced lower than expected braking performance and reported aquaplaning during the landing roll. The pilot flying used the aquaplaning response technique to maintain directional control and subsequently commanded maximum reverse thrust.

The aircraft stopped 70 m beyond the end of the runway inside the runway end safety area. There were no injuries to crew or passengers and an inspection of the aircraft found that the loose gravel had damaged some of the landing gear components

What the ATSB found

The combination of the approach speed required by the prevailing wind conditions and the poor braking effectiveness in the wet conditions resulted in the aircraft overrunning the runway.

The ATSB also found that despite assessing the weather as a threat, the flight crew did not identify the potential effect of the rainfall on the stopping distance. Additionally, neither the operator nor the regulator had guidance to allow the crew to recognise the conditions at the time as a hazard to the operation.

Prior to the occurrence, the runway had been examined and found to be requiring maintenance to ensure an adequate level of surface friction, however no maintenance was performed.

What has been done as a result

Following the occurrence, the operator circulated additional guidance and procedures to flight crew for identifying runway water contamination and to ensure appropriate speed control on approach and landing.

Since the occurrence, the Civil Aviation Safety Authority has published guidance, reflecting research from the United States Federal Aviation Authority, that found landing on ungrooved runways in moderate rain has the potential to significantly affect braking performance.

Safety message

Active precipitation, particularly moderate to heavy rainfall, is one of many factors that can influence the stopping distance of an aircraft. Water on a runway that is not grooved can significantly reduce the ability of the aircraft to slow down. In wet weather, additional conservatism is encouraged when calculating the required landing distances.

Operators and pilots are encouraged to review the latest guidance and tools available in relation to maintaining safety on runways and the factors that cause runway overruns.

Contents

The occurrence

On 9 January 2020, a Fokker 100 registered VH-NHY and operated by Network Aviation (a subsidiary of the Qantas Group), was conducting a regular public transport service from Perth to Newman, Western Australia.

Pre-flight, departure and cruise

The flight crew arrived at the airport at about 0430 Western Standard Time[1] to prepare for the flight. During the pre-flight briefing, the flight crew received the weather forecast for Newman, which included:

- crosswind gusting to 25 knots
- moderate to severe turbulence below 5,000 ft
- visibility of 7,000 m
- cloud cover[2] broken at 800 ft
- heavy rain

As a consequence of the significant weather, the captain requested additional fuel to provide for a potential diversion to an approved alternate, Port Hedland Airport. The weather observation from Newman Airport at the time indicated that the cumulative rainfall since 0900 the previous day was 87.6 mm.

The aircraft departed Perth at 0536 with 5 crew and 88 passengers on-board. Due to the unfavourable weather, the captain assumed the role of pilot flying and the first officer (FO) was pilot monitoring.[3]

During the cruise phase, the FO requested the latest Newman meteorological aerodrome report from Melbourne Centre. The controller provided updated observations for the destination, which included:

- wind 150° at 19 knots, gusting to 30 knots
- a reduction in visibility (reduced to 2,500 m)
- cloud covers of scattered at 700 ft, broken at 1,100 ft and broken at 1,600 ft
- recorded (actual) rain (1.6 mm within preceding 10 minutes, equivalent to 9.6 mm/hour).[4]

The approach

The captain reported that due to the potential for windshear during the final approach segment, a flaps 25 (rather than flaps 42) with speed brake extended approach was selected, resulting in a faster than usual final approach speed (V_{APP})[5]. The operator's procedures (see the section titled *Operator documentation and guidance*) and the Fokker flight manual required an additional 10

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1 Western Standard Time (WST): Coordinated Universal Time (UTC) + 8 hours.

2 Cloud cover: in aviation, cloud cover is reported using words that denote the extent of the cover – 'few' indicates that up to a quarter of the sky is covered, 'scattered' indicates that cloud is covering between a quarter and a half of the sky, 'broken' indicates that more than half to almost all the sky is covered, and 'overcast' indicates that all the sky is covered.

3 Pilot flying (PF) and pilot monitoring (PM): procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances; such as planning for descent, approach and landing. The PM carries out support duties and monitors the PF's actions and the aircraft's flight path.

4 The Bureau of Meteorology definition of heavy rainfall is greater than 6 mm/hr (see the section titled *Federal Aviation Administration (FAA) Safety Alert for Flight Operators (SAFO) 19003*)

5 V_{APP} is the final approach speed. The airspeed to be maintained down to 50 ft over the runway threshold. Usually determined as V_{REF} plus a margin for wind.

knots be added to the usual reference landing speed (V_{REF}[6] + 5 knots) to account for wind, bringing the final approach speed to 153 knots.

The captain reported not calculating the landing field length required on the day as they routinely operated to Newman and knew that the performance of the aircraft would allow for landing at maximum landing weight in dry or wet conditions. At interview, the captain recalled that the required landing field length for flaps 25 and maximum landing weight, the configuration and weight on the day, was about 1,750 m.

Prior to commencing the approach briefing, the flight crew interrogated the Newman aerodrome weather information service (AWIS).[7] The information they received was consistent with the previous weather observations provided by Melbourne Centre, except the wind direction had changed to 130º. Due to the wind direction the crew elected to conduct an approach to runway 05.

As part of the approach brief, the flight crew identified the weather as the primary threat to the operation and discussed a potential diversion to Port Hedland. Their discussions were focussed on the cloud base and the visibility required to conduct the approach, the expectation of windshear, turbulence and the strong crosswind. The rainfall rate and potential for runway contamination or reduced braking effectiveness were not discussed.

At 0655, 17 minutes prior to landing, the flight crew reinterrogated the AWIS. The visibility had reduced to 1,200 m and the rainfall rate had increased to 4.8 mm in 10 minutes (28.8 mm per hour). The captain commented to the FO that the reduced visibility was likely related to a rain shower.

Flight recorder data indicated that the approach was within the operator's stable approach criteria. Recorded values of airspeed during the final approach and landing showed fluctuations consistent with gusty conditions. At the decision height, coincident with the FO beginning to state 'no contact',[8] the captain announced that the runway was in-sight and continued the approach.

At interview, the FO explained that they[9] were unable to see the runway due primarily to two factors. The FO was not familiar with the approach, which had a 6º offset angle between the approach path and the runway, causing the nose of the aircraft to point right of the centreline. This difference between the approach course and the runway heading was exacerbated by the crosswind from the right of the runway, further pushing the nose of aircraft to the right of the centreline.

At the time that the captain announced that the runway was in sight, the aircraft was 3.4 km from the runway threshold, which was the required visibility for the approach.

The flight crew reported that during the approach the rainfall was of a moderate intensity. The aerodrome reporting officer (ARO) reported observing a slight increase in the rain intensity just prior to the aircraft landing but considered it to be moderate rain.

Landing

At 0712, the time of the landing, a maximum crosswind gust of 35 knots was recorded.[10] This was the highest recorded gust between 0700 and 0730. The crosswind limit for the Fokker 100 is

6 V_{REF} is the reference landing speed, defined to provide suitable safety margin during landing. Usually it is 1.3 times the stall speed with full flaps or selected landing flaps.

7 The AWIS provides actual weather conditions, via telephone or radio broadcast, from Bureau of Meteorology (BoM) automatic weather stations, or weather stations approved for that purpose by the BoM.

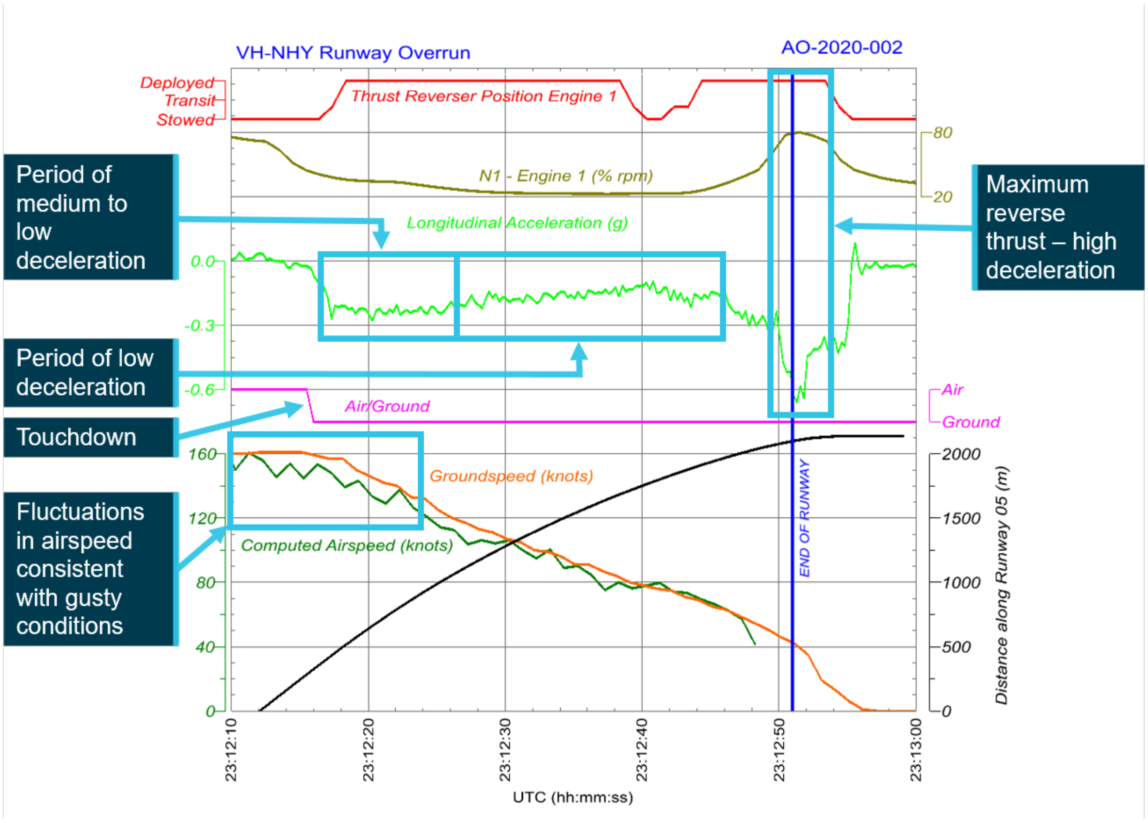
8 A 'no contact' call informs the captain that the FO does not have the runway in sight.

9 The ATSB uses gender neutral pronouns, including using the singular version of 'they'.

10 The BoM Automatic Weather Station records highest wind gust for each minute.

35 knots. The aircraft touched down at 154 knots airspeed and a groundspeed of 159 knots (Figure 1). The touchdown was positive[11] and at, or slightly before, the touch down zone.

Figure 1: Flight data from the occurrence landing



Source: ATSB

Eleven seconds after landing, the captain requested assistance with the brakes[12] from the FO. The recorded deceleration during this part of the landing was medium to low (less than 0.25 G) and reduced further as the landing roll progressed (Figure 1). Throughout the landing, there were directional oscillations about the runway heading as the aircraft weathercocked into the strong crosswind.

The captain reported that the aircraft aquaplaned during the landing. Approximately 20 seconds after touching down, the aquaplaning response technique was conducted. This involved reducing manual braking (brake pressure) with the intent of regaining traction and stowing the thrust reversers to increase directional stability. After completion of the aquaplaning response technique, maximum reverse thrust was applied which provided high deceleration (greater than 0.5 G) just before the aircraft departed the runway.

The aircraft stopped about 70 m beyond the upwind runway threshold, off the runway surface, within the runway end safety area[13] (Figure 2). There were no injuries and the passengers and crew disembarked via the front stairs and were transported to the terminal.

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11 A positive touchdown is a firm landing, encouraged when there is a risk of aquaplaning, to ensure good contact between the tyres and the runway surface.

12 The aircraft was not equipped with auto braking. However, an anti-skid system was fitted.

13 Runway end safety area is an area at the end of the runway (off the runway), clear of hazards, that limits the consequences when aircraft overrun or undershoot a runway.

Figure 2: Image taken of the aircraft stopped within the runway end safety area

Source: Network Aviation

A visual examination of the tyres identified some deep scratches, likely due to the abrasive surface of the runway end safety area. An inspection of the aircraft found that the loose gravel had damaged some of the landing gear components.

Context

Pilot information

At the time of the occurrence, the captain had 5,594.7 hours total flying time with 1,963.4 hours on the Fokker 100. The captain had flown regularly to Newman, the last time being the week prior.

The first officer had 2,920.5 hours total flying time with 182.8 hours on the Fokker 100. It was the first officer's second time flying into Newman.

Runway information

Newman Airport runway 05/23 was 2,072 m long, 30 m wide and ungrooved (lateral grooving is used to improve braking performance in wet conditions).

The most recent maintenance on the runway surface was a retexturing and excess rubber removal completed in June 2018 after a Civil Aviation Safety Authority (CASA) audit found that severe pavement bleeding and flushing[14] was occurring at the touchdown zones.

On the morning of the occurrence, the aerodrome reporting officer[15] (ARO) at Newman Airport inspected the runway at 0500 and again at 0630, 45 minutes before the aircraft landed. This was in accordance with the ARO's procedures for the runway to be inspected 'as soon as practicable prior to the first RPT [regular public transport] flight'. At those times, the ARO recalled a significant amount of standing water on the grass strips on either side of the runway. However, the ARO described that the main runway surface appeared clear of any noticeable standing water and was serviceable throughout the morning.

About a year after the occurrence, an image was taken of the runway showing standing water on the runway after rainfall (Figure 3).

Figure 3: Image of standing water on the runway at Newman Airport.

Source: Qantas

[14] 'Bleeding and flushing' of pavement refers to the bituminous substance that holds the asphalt aggregate together seeping up to the surface.

[15] An ARO's main duties relate to safety and include inspecting runways, reporting hazardous situations and facilitating repairs. These duties include ensuring the safety of runways.

Friction tests

Aerodrome operators were required to ensured that runway friction levels were above minimum limits[16] as detailed in Part 139 (Aerodromes) of the Manual of Standards 2017, version 1.14, which was current at the time. In order to demonstrate compliance, the friction was required to be periodically tested via one of the prescribed methods. The Manual of Standards also specified the 'maintenance planning level' for friction, which is the level that if the measured friction falls below the aerodrome operator must initiate appropriate corrective maintenance action to improve the friction and ensure ongoing safety of the runway.

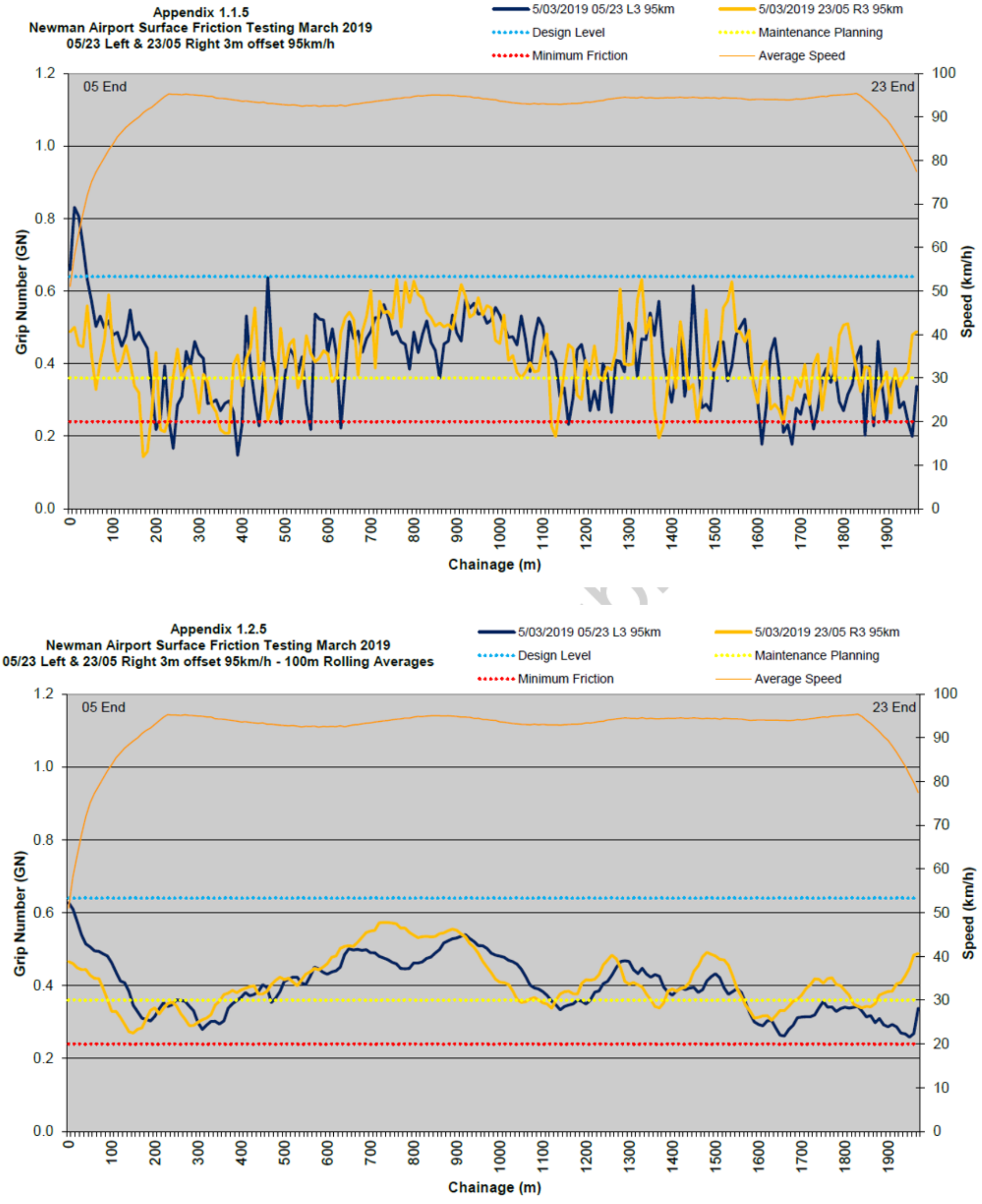
A runway friction test was conducted in March 2019. The test took continuous skid resistance measurements at 3 and 6 m offsets from the centreline at 65 km/h and 95 km/h. These measurements were averaged over 10 m to produce a continuous data plot of the friction. A 100 m rolling average was also included in the friction test report.

The report described the differences between the 65 and the 95 km/h test indicating that the 65 km/h test was affected more by the microtexture of the surface and the 95 km/h test was more affected by the macrotexture. Low friction values for the 65 km/h test indicated that the fine texture may be filled with rubber. The 95 km/h test gave an indication of how fast water was able to escape from the surface. The report also stated that seasonal variation can affect the friction measurements by up to 15 per cent.

The continuous friction measurements for the 95 km/h test recorded numerous measurements below the maintenance planning level and some measurements below the allowable minimum friction levels (Figure 3). However, when averaged over 100 m, the lowest friction measurements were at maintenance planning level. The Manual of Standards had no requirement, nor did it specifically permit the averaging of the friction measurements.

[16] The MOS stated that if the measured friction level fell below the relevant Minimum friction level values, the aerodrome operator must promulgate by NOTAM, that the runway pavement fell below minimum friction level when wet. Additionally, corrective maintenance action must be taken without delay. This requirement applied when friction characteristics for either the entire runway or a portion thereof were below the minimum friction level.

Figure 4: Results from runway friction report



These plots show the data from the 95 km/h test at 3 m offset from centreline. The upper image shows 10 m averages considered to the continuous friction measurement, the lower image is the same data using 100 m rolling averages.
Source – Fulton Hogan

The report did not mention the friction values below the minimum design limit and concluded that:

- there were sections of the runway at maintenance planning level
- the runway met the surface friction requirements as specified in the Manual of Standards.

Several weeks after the occurrence the runway was re-tested via the same method. The friction values recorded in the 2020 test were generally higher (i.e. better grip). However, there were still areas in the touch down zones that were at maintenance planning level. No rubber removal or surface maintenance had been performed between the 2019 and 2020 tests.

Aquaplaning

The three types of aquaplaning are dynamic, viscous and reverted rubber.

- Dynamic aquaplaning occurs at high-speed and is the result of water being unable to be forced away from under the tyre. This creates a layer of water underneath the tyre thereby reducing the coefficient of friction.
- Viscous aquaplaning is a similar phenomenon but can occur at lower speeds and relies on a low coefficient of friction of the runway surface, usually due to rubber build up. The smooth surface enables a small film of water to cause the tyre to slip during braking.
- Reverted rubber aquaplaning is the breakdown of the tyre material from heat generated as part of the braking or as a result of a skid or lockup. Reverted rubber aquaplaning is the only type of aquaplaning that leaves evidence marks on the tyre surface.

Runway contamination

The Civil Aviation Order (CAO) 20.7.1B defined a contaminated runway as a runway that has more than 25 per cent of the runway surface area within the required length and width being used covered by:

- water, or slush, more than 3 mm deep; or
- loose snow more than 20 mm deep; or
- compacted snow or ice, including wet ice.

Advice from runway subject matter experts indicated that strong crosswinds can increase the chances of the windward side of the runway being contaminated. This is because the wind effectively slows or stops the water from draining along the built-in slope away from the centreline.

Federal Aviation Administration (FAA) Safety Alert for Flight Operators (SAFO) 19003

In response to several landing events where the braking coefficient was found to be less than what was expected for a wet runway, the United States Federal Aviation Administration (FAA) issued Safety Alert for Flight Operators (SAFO) 15009 in August 2015. In 2019, this SAFO was updated with SAFO 19003 (Turbojet Braking Performance on Wet Runways) to align with current guidance.

While the FAA recognised that landing overruns on wet runways usually involved multiple contributing factors, their analysis of those landing events raised concerns regarding stopping performance assumptions. The cause of the braking underperformance was not fully understood, but the FAA in SAFO 15009 cited possible factors relating to runway conditions including texture, drainage, puddling in wheel tracks and active precipitation. Specifically, the analysis showed that, 30-40 per cent of additional stopping distance may be required in certain cases where the runway was very wet, but not flooded.

As a result of the above, the FAA suggested that whenever there is likelihood of moderate or greater active rain on a smooth (ungrooved) runway, or heavy rain on a grooved or porous friction course runway, landing distance calculations should be done assuming the surface is contaminated.

There is no standard definition of rainfall intensity across the aviation industry. However, the World Meteorological Organization[17] stated:

[17] Aviation | Hazards | Precipitation | World Meteorological Organization (wmo.int)

> While there is no agreed international definition regarding rainfall intensity, some use the following criteria: Heavy rain is defined as rates in excess of 4 mm per hour while heavy showers are defined as rates in excess of 10 mm per hour. Showers are further classified as being violent if the rate exceeds 50 mm per hour, although these are normally considered to be rates typical for tropical regions.

The below table includes the published definition from the FAA and the Australian Bureau of Meteorology (BoM).

Table 1: Comparison of rain intensity definitions between FAA and BOM

Rain intensity	FAA	BoM
Moderate	4.5 to 12.5 mm/hr	2.2 to 6 mm/hr
Heavy	12.5 to 50 mm/hr	Greater than 6 mm/hr

Calculation of required landing field length

Civil Aviation Order (CAO) 20.7.1B (Aeroplane weight and performance limitations) specified that landing distance required shall be 1.67 times the distance required to bring the aeroplane to a stop on a dry runway. For wet runways, an additional 15 per cent margin is to be added be added making the landing field length required 1.92 times the distance required to bring the aeroplane to a stop on a dry runway.

The Fokker 100 airplane flight manual (AFM) provided the required landing field length for flaps 25 for the aircraft weight as 1,520 m. In line with the CAO, the manual stated that if forecasts or observations indicate the runway may be wet, the required landing field length was an additional 15 per cent of the distance in dry conditions. This brought the required length to 1,748 m. These lengths were predicated on the aircraft being at the reference landing speed (V_{REF}) at 50 ft above the runway threshold.

Fokker provided advice to the ATSB that they recognised that in normal operation the threshold crossing speed is often higher than V_{REF}. In those cases, the landing distance may be larger than the landing distances determined during the certification flight tests of the aircraft. However, the increase will not be larger than the 1.67 factor used in the AFM graphs for required landing field length for dry conditions.

Operator documentation and guidance

Runway contamination

The weather briefing section of the Flight Administration Manual (FAM) indicated that the possibility of runways being contaminated at the departure and destination airports should be considered during the planning process. Network Aviation policy did not approve operations on contaminated runways. However, limited guidance within the documented material was provided on how to determine if the runway was contaminated, and moderate or heavy rain were not identified as possible runway contaminants.

The Fokker 100 Aircraft Operating Manual (AOM) contained a section for operating on contaminated runways. The section contained the CASA definition of contaminated runways and additional information on possible runway contamination. The section stated that a runway may also be considered contaminated in conditions including:

> A runway with a smooth/slippery surface (rubber deposits / oil) or a recently resurfaced runway covered with a thin layer of water (less than 3mm) […] may have a considerably reduced friction (slippery wet runways).
>
> In heavy rain showers even on runways with a good drainage.

The section also stated that:

> The magnitude of the effects of runway contamination are determined in general by: […]

- The runway surface condition and texture, grooved or non-grooved runways;
- The weather conditions (cross wind, gust, actual precipitation);
- The aircraft configuration (flaps, reversers, autobrakes, speedbrakes)

Advice was sought from the operator on how flight crew were expected to assess if a runway was contaminated. The operator indicated that the flight crew should check NOTAM's[18] prior to departure for any published runway unserviceability. During the flight, they should monitor the aerodrome weather information service (AWIS) broadcast, noting that the AWIS broadcast does not include any reference to standing water. There was also an expectation that the ARO strip inspection prior to the arrival would identify if the runway was contaminated and if so, contact the arriving aircraft. There was no guidance relating rainfall intensity to runway contamination.

Aircraft configuration selection

The configuration section of the AOM stated that:

> Flaps 42 should be used when landing on contaminated runways or runways with reduced braking action.

The windshear section of the AOM encouraged flight crew to consider using flaps 25 for landing and increasing approach speed if weather conditions were such that a windshear may possibly exist, but a safe approach and landing was thought to be feasible. The manual also stated that considerations should be given to the increased landing distance as a result of the increased approach speed.

Approach briefing

The approach briefing section of the Flight Crew Operating Manual (FCOM) listed inclement weather and adverse runway conditions as elements to brief as required. In accordance with the manual, the approach briefing consisted of five modules; Charts, Terrain, Weather, Operational and Plus. With Plus being the section of the approach brief for the crew to identify any threats not previously discussed.

The 'runway state' was a line item within the Operational section of the briefing, however, there was no additional information provided on how to assess the runway state.

Regulator guidance

At the time of the occurrence, there was a Civil Aviation Advisory Publication (CAAP) 235-05 which had advisory information on landing distance. However, this did not reflect the latest FAA guidance on the potential contamination and reduction in braking performance resulting from active moderate or heavy precipitation on an ungrooved runway.

In October 2020, 10 months after the occurrence, CASA published an update to the CAAP 235-05 - New performance provisions for CAO 20.7.1B and CAO 20.7.4. Section 3 of the update, titled Landing Distance, included advice on landing in very wet conditions. Included was the information from, and a reference to, the FAA SAFO 19003 (discussed above) identifying moderate active precipitation and ungrooved runways as being risks to landing performance.

Related occurrences

In 2015, an Australian registered Boeing 737 landing at Christchurch, New Zealand, in wet conditions, did not decelerate as expected and stopped 5 m from the runway end. The ATSB

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[18] NOTAM or Notice(s) to Airmen give information on the establishment, condition or change in an aeronautical facility, service, procedure, or hazard.

investigation (AO-2015-046) found that the reduced braking effectiveness was likely as a result of water on the runway.

Relevant publications

In 2008, the ATSB published a two-part research report (AR-2008-018) titled Runway Excursions with the objective of analysing international and Australian trends in runway excursions. Part 1 of the report explored the contributing factors associated with runway excursions between 1998 and 2007. Water-affected and contaminated runways was one of the contributing factors identified.

In May 2009, the Flight Safety Foundation published a Runway Safety Initiative that provided practical guidance and tools for operators to lower the risk of runway excursions. https://flightsafety.org/files/RERR/fsf-runway-excursions-report.pdf

Safety Analysis

After touching down on runway 05 at Newman Airport the aircraft did not decelerate as expected. The captain, sensing the aircraft aquaplane, conducted the aquaplaning response technique and subsequently applied maximum reverse thrust, stopping the aircraft 70 m beyond the upwind runway threshold. This analysis will cover the speed at touchdown, the braking effectiveness, and the environmental conditions at touchdown; as well as the information available to the flight crew to conduct their threat assessment and the condition of the runway.

Landing speed, wind conditions and braking performance

The flight crew selected the approach speed based on the known environmental conditions. The selection was a correct application of the guidance for the forecast turbulence, due to the possibility of windshear conditions. The flaps 25 approach along with the additional mandated speed margins, due to the wind conditions, resulted in a higher approach airspeed than for a flaps 42 approach.

The final approach speed was flown as planned however, the aircraft did not slow after crossing the threshold and entering the flare. During this period, a higher groundspeed than airspeed was recorded indicating a possible unforecast tailwind component, which may have limited the ability to reduce the speed. A higher touchdown speed requires a longer stopping distance due to the additional energy to be dissipated by the deceleration devices. As a general rule, a 10 per cent increase in approach speed results in a 20 per cent increase in the required landing distance.

During the landing roll, after the captain (pilot flying) asked for assistance with applying the brakes, it is highly likely that the maximum manual braking effort was being applied. During this same period, the recorded deceleration was low, indicating that the braking effectiveness was reduced. The captain's report of aquaplaning is consistent with this low deceleration and the directional oscillations recorded during the landing.

The crosswind conditions combined with the aquaplaning increased the difficulty of maintaining directional control. In accordance with the advice in the Aircraft Operating Manual in relation to aquaplaning response, the crew were limited in the amount of reverse thrust that could be applied as the priority was on maintaining the directional stability and keeping the aircraft on the centreline. Without the crosswind, it is likely that the captain could have engaged maximum reverse thrust much earlier in the landing roll, which would have significantly reduced the landing distance.

Given the magnitude of the runway overrun (70 m), it is highly likely that if either the landing speed had been reduced, the braking effectiveness had been normal or there had been less crosswind, the overrun would not have occurred.

Threat identification

During the approach briefing, the flight crew correctly identified the primary threat as the significant weather. However, their focus was primarily on the wind and the visibility. Despite the forecast for heavy rain obtained before the flight and the aerodrome weather information service providing observations of heavy rain occurring there was no consideration of the effect of the rainfall on the runway state or the braking performance.

The faster flaps 25 approach was selected to address the identified threat of possible windshear. However, this selection (compared to the standard flaps 42 approach) further increased the risks associated with reduced runway braking performance. The crosswind was discussed in relation to the selection of the runway but was not identified as possibly affecting the ability of the aircraft to brake effectively or reducing the drainage of water from the runway surface on the windward side.

The approach briefing procedure provided a prompt to discuss the runway state. However, there was no information available to the crew to enable them to identify the potential for a significant reduction in braking performance posed by the active moderate rainfall. As a result, had the crew identified and discussed the threat, the options for them to manage the threat were limited to their own judgement. Therefore, it is possible that even if the flight crew had identified the threat, they would have continued the approach. There was no information reasonably available to the crew to assist them to identify the runway as potentially water contaminated by the active rainfall.

Operator and regulator documentation

Network Aviation policy did not permit operations on contaminated runway however, flight crews were not provided with adequate information to identify all possible runway contaminated situations. At the time of the occurrence, the only information relevant to the conditions on the day within the operator’s document suite was advisory information in relation to heavy rain being a possible contaminant of the runway. There were no specific procedures to identify the rainfall intensity or relating to conducting approaches during active precipitation.

The United States Federal Aviation Administration (FAA) safety alert for flight operators (SAFO) provided a practical means to assess the potential for runway contaminations based solely on the type of runway surface (grooved or ungrooved) and the rain intensity at landing. Using the FAA document and guidance on rainfall intensity it would have been possible for the crew to determine that there was a potential for poor braking performance and take some mitigating action.

At the time of the occurrence, the lack of Civil Aviation Safety Authority (CASA) advisory information reflecting the FAA alert regarding the potential effect of active moderate or heavy rainfall on braking performance, reduced the likelihood that the operator would have the appropriate guidance for mitigating this hazard.

Runway condition

The flight crew and the aerodrome reporting officer (ARO) reported moderate rain at the time of the landing. The lack of grooving on the runway reduced the ability of water to drain from the runway surface. The FAA SAFO advised that moderate rain on an ungrooved runway can cause a significant reduction in braking performance. The heavy rain prior to the final approach and the ARO’s observations in relation to the water accumulation around the runway meant that drainage of water from the runway may have been slower than usual at the time of landing. The high crosswind at the time of landing would also have slowed the drainage of water on the windward side of the runway.

The runway friction measurements taken in 2019 had values below the recommended maintenance planning levels and some measurements below the minimum friction limits as specified by the Manual of Standards. Although still safe for operations, at the levels recorded, it would generally be expected that maintenance should be performed in the lower friction areas to ensure ongoing safe operation on the runway.

The water pooling observed a year after the occurrence may have been present at the time of the occurrence but would have been hard to identify during active precipitation.

Had there been additional maintenance performed on the runway, there would have been an increase in the overall friction of the runway. However, while an increase in friction may have affected the outcome on the day, it is not possible to conclusively state that the overrun would not have occurred.

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition 'other findings' may be included to provide important information about topics other than safety factors.

Safety issues are highlighted in bold to emphasise their importance. A safety issue is a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the runway overrun involving VH-NHY at Newman Airport on 09 January 2020.

Contributing factors

- The combination of the approach speed required by the prevailing wind conditions and the poor braking effectiveness in the wet conditions resulted in the aircraft overrunning the runway.

Other factors that increased risk

- During the flight, the potential for the heavy or moderate rainfall to significantly impact the landing distance was not recognised by the flight crew and therefore not considered as a threat.
- Despite technical examination of the runway identifying areas requiring maintenance to maintain the surface friction, no corrective action was taken.
- **The operator's documentation required crew to consider contamination of runways at the departure and destination airports. However, the provided definition and guidance did not include the means to identify water contamination from active rainfall. (Safety Issue)**
- **CASA advisory publications did not include information regarding the potential for reduction in braking performance resulting from active moderate or heavy rainfall. (Safety Issue)**

Safety issues and actions

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues. The ATSB expects relevant organisations will address all safety issues an investigation identifies.

Depending on the level of risk of a safety issue, the extent of corrective action taken by the relevant organisation(s), or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue a formal safety recommendation or safety advisory notice as part of the final report.

All of the directly involved parties are invited to provide submissions to this draft report. As part of that process, each organisation is asked to communicate what safety actions, if any, they have carried out or are planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions will be provided separately on the ATSB website on release of the final investigation report, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website after the release of the final report as further information about safety action comes to hand.

Operator guidance

Safety issue description

The operator's documentation required crew to consider contamination of runways at the departure and destination airports. However, the provided definition and guidance did not include the means to identify water contamination from active rainfall.

Issue number:	AO-2020-002-SI-01
Issue owner:	Network Aviation
Transport function:	Aviation: Air transport
Current issue status:	Closed – adequately addressed
Issue status justification:	The safety action provides flight crews with clear information to assess and mitigate the hazard of contaminated runways.

Proactive safety action taken by Network Aviation

Action number:	AO-2020-002-PSA-01
Action organisation:	Network Aviation
Action date:	31 January 2020
Action status:	Closed

On 31 January 2020, the following guidance was issued by Network Aviation:

- A flight standing order in relation to planning to Limited Runways which required the crew to plan for an alternate on runways less than 2,200 m, when there is a possibility of wet runway, and crosswind greater than 20 knots.
- An accompanying Memorandum with detailed explanations for determining moderate and heavy rainfall and the effect on landing distance required for wind corrections in wet and dry conditions.
- A flight standing order which banned an approach (unless a greater emergency exists) to non-controlled aerodromes where moderate or heavy rain is reported or observed.

Regulator guidance

Safety issue description

Civil Aviation Safety Authority (CASA) advisory publications did not include information regarding the potential for reduction in braking performance resulting from active rainfall.

Issue number:	AO-2020-002-SI-02
Issue owner:	Civil Aviation Safety Authority
Transport function:	Aviation: Air transport
Current issue status:	Closed – adequately addressed
Issue status justification:	The revised advisory publication includes detail on the hazardous effect of rainfall on aeroplane braking.

Proactive safety action taken by CASA

Action number:	AO-2020-002-PSA-02
Action organisation:	Civil Aviation Safety Organisation
Action date:	October 2020
Action status:	Closed

In October 2020 CASA published an updated version of Civil Aviation Advisory Publication 235-05, which included a section on operating in very wet conditions. This advisory publications also referred to the safety alert published by the FAA.

Safety action not associated with an identified safety issue

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Additional safety action by Network Aviation

Network Aviation advised that they have taken the following proactive safety action in response to this occurrence:

- Flight Crew experienced scenarios of potentially contaminated runway during the 2021 1A/1B cyclic training program.
- Network Aviation have engaged with the aerodrome reporting officer to confirm reliability of aerodrome weather information service.
- Runway overrun protection system has commenced implementation and fitment to the A320 fleet.
- Flight Operations governance amended to provide enhanced and embedded F100/A320 Touchdown Zone scatter plot reporting to monitor runway excursion risk.
- Implemented pre-cyclic quiz for all pilots - verifying knowledge of runway surface condition requirements
- Qantas group and other airlines sharing consistent approaches to contaminated runways, ensuring aligned procedures.
- Benchmarking and sharing Runway Excursion Risk flight data analysis program data across Qantas group to drive continuous improvement.

General details

Occurrence details

Date and time:	9 January 2020 0723 WST	
Occurrence category:	Incident	
Primary occurrence type:	Runway Excursion	
Location:	Newman Airport, Western Australia	
	Latitude: 23° 24.79' S	Longitude: 119° 48.69' E

Aircraft details

Manufacturer and model:	Fokker Aircraft B.V. F28 MK 0100	
Registration:	VH-NHY	
Operator:	Network Aviation	
Serial number:	11467	
Type of operation:	Air Transport High Capacity - Passenger	
Departure:	Perth Airport, Western Australia	
Destination:	Newman Aerodrome, Western Australia	
Persons on board:	Crew – 5	Passengers – 88
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Minor	

Glossary

AFM	Airplane flight manual
AOM	Aircraft operating manual
ARO	Aerodrome reporting officer
AWIS	Aerodrome weather information service
BoM	Bureau of Meteorology
CAAP	Civil Aviation Advisory Publication
CAO	Civil Aviation Order
CASA	Civil Aviation Safety Authority
FAA	United States Federal Aviation Administration
FAM	Flight administration manual
FCOM	Flight crew operations manual
FO	First officer
ICAO	International Civil Aviation Organization
PF	Pilot flying
PM	Pilot monitoring
RPT	Regular public transport
SAFO	Safety Alert for Flight Operators
V_{APP}	Final approach speed
V_{REF}	Reference landing speed
WMO	World Meteorological Organization

Sources and submissions

Sources of information

The sources of information during the investigation included:

- Network Aviation
- flight recorder data
- the involved flight crew
- the duty aerodrome reporting officer and East Pilbara Shire council
- aerodrome subject matter experts
- Bureau of Meteorology.

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the following directly involved parties:

- Network Aviation
- flight crew
- East Pilbara shire council
- Civil Aviation Safety Authority
- Fokker
- Dutch Safety Board

Submissions were received from:

- Network Aviation
- the flight crew
- East Pilbara shire council
- Civil Aviation Safety Authority

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis and research
- fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, international agreements.

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.