



## AIRCRAFT ACCIDENT INVESTIGATION GROUP OF BANGLADESH (AAIG-BD)

4<sup>th</sup> Floor, CAAB Headquarters, Kurmitola, Dhaka-1229

Bangladesh



### FINAL INVESTIGATION REPORT OF B-777 RUNWAY EXCURSION AT VGHS DHAKA BANGLADESH ON 24-07-2018

#### FOREWORD

#### FINAL REPORT

#### **Investigation into the Serious Incident of B-777 Aircraft, Nationality and Registration Mark HS-TJD of Thai Airways International Public Company Ltd on 24 July 2018 at Hazrat Shah Jalal International Airport, Dhaka, Bangladesh**

This serious incident investigation has been performed in accordance with Civil Aviation Act 2017, pursuant to Part 13 of CAR 1984 and in conformity with Annex 13 to the Chicago Convention on International Civil Aviation. The delegation of investigating authority was accorded to the Head of Aircraft Accident Investigation Group of Bangladesh (AAIG-BD), vide Office Order CAAB/CS/32/AAIG-BD/01/MASTER, dated 22 June 2016.

The Head of AAIG-BD received a Mandatory Occurrence Report (MOR) through an e-mail sent by the Vice President of Corporate Aviation Safety, Security and Standards of Thai Airways International Public Company Limited narrating about the runway excursion during landing at Hazrat Shah Jalal International Airport (VGHS) Dhaka, Bangladesh on 24 July 2018 of Flight TG 321 (BKK-DAC) involving a Boeing 777-200 aircraft, Registration Mark HS-TJD. The report indicated that there were 2 Flight crew and 13 Cabin crew Plus 1 Ground Engineer with 14 business class and 141 economy class passengers on board. The report further indicated that 6 tyres of the aircraft were blown out.

Immediately following the occurrence, the Head of the AAIG-BD constituted an Aircraft Accident Investigation Team (AAIT) comprising four (04) investigators of which the Head of AAIG-BD himself was the IIC to conduct the necessary investigation.

The Preliminary Investigation Report of the occurrence was published on 23 August 2018 which was sent to all relevant States and Organizations as per Standard 7.1 of Annex 13 and is being displayed in CAAB website ([www.caab.portal.gov.bd/](http://www.caab.portal.gov.bd/)) since 23 August 2018 for information to public.

A draft final report on this occurrence was prepared and sent to different States and Administrations/Organizations on 02-12-2018 for comments as per ICAO Annex 13 and the Compendium on Aircraft Accident Investigation Group, Bangladesh (AAIG-BD). Comments received from various States and Organizations have been included to restructure this final report.

The sole objective of this investigation is to prevent aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

The information contained in this report has been derived from the factual information and evidences gathered during the ongoing investigation of the occurrence.

The AAIG-BD has drawn a few safety recommendations for relevant States and Administrations/Organizations to take corrective actions. In this regard States and Administrations/Organizations are requested to please comment, if any, on the safety Recommendations ensuring that the comments reach the Head of AAIG-BD within 90 days from the receipt of this report. The Head of AAIG-BD, thereafter, will finalize the Safety Recommendations and dispatch to States and Administrations/Organizations, as applicable, for necessary corrective actions. The Head of AAIG-BD requests that the corrective action, so taken, may be sent at the earliest to the AAIG-BD for necessary record keeping.

The AAIG-BD reiterates that in the event new evidence appears in future that requires changes to the information depicted in this report, the investigation will be reopened as per Standard 5.3 of ICAO Annex 13. However, this final report represents the complete investigation, which will be made to public in due course of time, in conformity with ICAO Annex 13.

Head of AAIG-BD

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## 1. TITLE

**Investigation into the Serious Incident of B-777 Aircraft, Nationality and Registration Mark HS-TJD of Thai Airways International Public Company Ltd on 24 July 2018 at Hazrat Shah Jalal International Airport (VGHS) Dhaka, Bangladesh**

Para	Heading	Description
1.1	Name of Operator	Thai Airways International Public Company Ltd
1.2	Name of Manufacturer	Boeing
1.3	Aircraft Model	B777-2D7
1.4	Aircraft Nationality	Thailand
1.5	Aircraft Registration Marks	HS-TJD
1.6	Place of Occurrence	Hazrat Shah Jalal International Airport (VGHS), Dhaka, Bangladesh
1.7	Date of Occurrence	24 July 2018

## 2. SYNOPSIS

Para	Heading	Description
2.1	Notification of accident to national and foreign authorities	<p>The Head of the Aircraft Accident Investigation Group of Bangladesh (AAIG-BD) has notified to all relevant Authorities and Organizations/Agencies as per Standard 4.1 of ICAO Annex 13, Civil Aviation Authority Bangladesh, Rule 235 and Part C Para-6 of the Compendium of Aircraft Accident Investigation Group of Bangladesh (AAIG-BD). The notification included the following addresses:</p> <ol style="list-style-type: none"> <li><b>The State of Registry:</b> Thailand (Aircraft Accident Investigation Committee of Thailand &amp; Civil Aviation Authority of Thailand);</li> <li><b>The State of Operator:</b> Thailand (Civil Aviation Authority of Thailand and Managing Director, Thai International Airways Ltd);</li> <li><b>The State of Occurrence:</b> (Minister MOCAT, Secretary MOCAT, Chairman CAAB, Member OPS CAAB, Director Flight Safety &amp; Regulations CAAB and the Aircraft Accident Investigation Team designated by AAIG-BD);</li> <li><b>The State of Manufacturer :</b> USA (National Transportation Safety Board &amp; Boeing);</li> <li><b>The State of Design:</b> NTSB; USA (National Transportation Safety Board &amp; Boeing); a</li> <li><b>Other Organizations:</b> International Civil Aviation Organization (ICAO) and Transport Safety Investigation Bureau of Singapore (TSIB).</li> </ol>
2.2	Accident investigation Authority	Aircraft Accident Investigation Group of Bangladesh (AAIG-BD) CAAB Headquarters, Kurmitola, Dhaka, Bangladesh;
2.3	Accredited Representation	<p>a) Four (04) Accredited Representatives, namely AAIC Thailand, NTSB USA, EASA EU and TSIB Singapore had expressed their willingness to participate in the investigation. The AAIG-BD has included them to participate in the investigation;</p> <p>b) While the Head of the AAIG-BD expressed thanks for the willingness of the Accredited Representatives to participate in the investigation, effective participation was sought from AAIC Thailand and TSIB Singapore;</p>

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		c) The TSIB Singapore provided its facility and expertise for the decoding of the CVR and FDR. The decoding and analysis of the CVR and FDR was actively participated by the IIC (Head of AAIG-BD) and the Accredited Representatives from AAIC Thailand, who participated with four advisors.
2.4	Organization of the Investigation	Aircraft Accident Investigation Team (AAIT), designated by the Head of the AAIG-BD through a 'Memorandum'.
2.5	Authority releasing the report	Aircraft Accident Investigation Group of Bangladesh (AAIG-BD).
2.6	Date of publication of report	10 April 2019
2.7	Brief resume of circumstances leading to the accident	<p>a) The aircraft was flown by the co-pilot who made an ILS approach at Runway 14 at Hazrat Shah Jalal International Airport (HSIA), Dhaka, Bangladesh for landing during moderate to heavy rain with about 10-11 Knots of cross wind component from right side. During the final approach, visual contact with the Runway was not established by either of the flight crew. The flight crew reported to have commenced a missed approach from the missed approach point (MAP).</p> <p>b) After commencing missed approach, the aircraft was initially flown under radar vector and was positioned for the second ILS approach for RWY 14 by the radar controller.</p> <p>c) The aircraft uneventfully made the second ILS approach for landing on RWY 14, this time by the Pilot in Command (PIC). The weather condition remained as before. The aircraft was flown along the ILS approach path until minima with Auto Pilot (AP) engaged. Earlier, the PIC discussed with the copilot that he would like to disengage the AP at a low altitude which was agreed by the copilot. The AP was disengaged at 135 Feet above ground level (AGL).</p> <p>d) While flying manually from 135 feet down to runway, the aircraft deviated slightly to the right into the wind and slightly below the normal glide path. The aircraft eventually touched down on the right half of the centerline of the wet runway surface at 576 feet down the threshold line of Runway 14 at an angle of about 05 degrees right with the runway heading.</p> <p>e) According to the DFDR read out, the PIC applied the left rudder immediately after touch down to bring the aircraft back to centerline. Although the fore and aft axis of the aircraft appeared to be parallel with the RWY, but no sooner the aircraft had rolled on the concrete surface for 768 feet, the right main landing gear of aircraft went into the grassy-mud.</p> <p>f) The aircraft then continued to roll down almost parallel to the runway with its nose and left main gears on the RWY concrete surface, still on the right half of the centerline, the right main gear remained on the wet grassy mud, for 1536 feet. During this time, the right main gear wheels overran over nine cable laying iron-sheet covered concrete pits, each having about 5 feet (length) x 4 feet (width) x 2 feet (depth) dimension, crashing about 3-4 pit covers and associated structures. Thereafter, the right main landing gear with at least four partially and/or completely ruptured/disintegrated tires and two of the wheels having broken rim, reverted back on the runway surface.</p>

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		g) The aircraft then rolled down the runway for further about 5000 feet while coming back to the centerline, went further left until clear of the RWY surface and entered the high speed taxi track (H) and stopped at the end of the high speed taxi track.
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**3. FACTUAL INFORMATION****3.1 History of Flight**

Para	Heading	Description
3.1.1	Flight number	TG 321
3.1.2	Type of operation	International passenger/cargo operation
3.1.3	Last point of departure	Suvarnabhumi Airport Bangkok, Thailand
3.1.4	Time of departure (Local or UTC)	0333 UTC
3.1.5	Point of intended landing	Hazrat Shah Jalal International Airport (VGHS), Dhaka, Bangladesh
3.1.6	Description of the flight and events leading to the accident	<p>a) TG 321 (BKK-DAC) was a scheduled Passenger flight originated from Suvarnabhumi Airport Bangkok, Thailand, for landing at Hazrat Shah Jalal International Airport, Dhaka, Bangladesh. According to the flight crew, the en-route flight was uneventful, but there were some cloud formation in and around Dhaka airfield. The aircraft requested to the Approach Controller of Dhaka for some weather deviations which were granted to the aircraft. When asked by the approach controller if the aircraft was out of weather, the flight crew replied that the aircraft will be clear of weather in 5 minutes. At this time the approach controller requested the aircraft to accept radar vector for RWY 14 when ready and advised the aircraft to descent to 4000 feet. Thereafter, the Approach Controller vectored the aircraft for ILS approach at Runway 14 and while the aircraft was at 6.5 miles from the threshold of RWY 14 at 0558:00 hrs, handed over to Dhaka Tower Controller for landing. At 0558:10 hrs, the aircraft reported to Tower Control that the aircraft had established ILS RWY 14 for landing. The Tower Controller relied, "TG 321 check gear down and locked, surface wind 230/11 kts, clear to land RWY 14, RWY surface is wet." To this transmission from tower, the aircraft replied, "Clear to land RWY 14, TG 321." The prevailing weather at Dhaka was moderate to heavy rain with about 10-11 Knots of cross wind component from the right. The runway surface was wet but without water logged. During the final approach, visual contact with the Runway was not established by the flight crew. At 0611:00 hrs, the flight crew reported to have commenced a go-around.</p> <p>b) The aircraft climbed to the missed approach altitude and thereafter the Tower Control handed over the aircraft to the Approach Control at 0612:00 hrs. At 0612:10 hrs the TG 321 had requested for radar vector for second attempt to land at RWY 14. When the aircraft was at 3000 feet, the Dhaka Approach Control cleared the aircraft to turn left heading initially to 350 degrees and thereafter to 300 degrees and to descent to 2000 feet. At 0613:58 hrs the aircraft reported to be established on the localizer. Approach Controller transmitted, "TG 321 10 Miles, check gears, continue approach". The flight crew replied, "Continue approach TG 321". At 0615:31 hrs the flight crew reported to be established ILS RWY 14 and at 0615:33, the Approach Controller handed the aircraft to Tower Control for landing. At 0615:40 aircraft reported to be in landing configuration and was four miles in final. At 0615:57, the PIC who was the pilot flying, asked the copilot if the checklists have been completed. The copilot replied that the checklists have already been completed;</p>

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		<p>c) At 0615:43, the Tower Control cleared the aircraft to land RWY 14 by transmitting, "Check gears down and green, surface wind two five zero 10 knots, caution for landing surface wet". The aircraft acknowledged the ATC transmission by replying, "Clear to land";</p> <p>d) At 0615:52, the Tower Control asked the aircraft if RWY has been sighted by the flight crew. At 0615:55, the flight crew replied that the RWY was not sighted. At 0616:01 the aircraft reached 1000 feet AGL. At 0616:53, the flight crew sighted the approach lights of the RWY at their 12 'O Clock. The weather conditions remained moderate to heavy rain with 10-11 knots cross wind. The flight crews were cautioned about the RW surface being wet. However, the aircraft continued approach and touched down on the right side of the centerline of the Runway 14 and at 576 feet down the threshold line of Runway 14.</p> <p>e) The outer rear wheel of the right main landing gear of the aircraft touched down first at 576 feet down the threshold line of runway 14 followed by the inner rear wheel of the right main landing gear. At the time of touch down the aircraft presumably had right bank with a heading of about 15 degrees right with the runway heading.</p> <p>f) After touchdown, the aircraft rolled on the concrete surface for 768 feet as defined by the continuous tyres marks. The aircraft maintained the same right offset heading with the runway heading until the outer wheels of the right main landing gear went into the grassy-mud followed by the inner wheels of the right main landing gear.</p> <p>g) Soon after, as defined by the continuous tyres marks, the aircraft now changed its heading to almost parallel with the runway and continued to roll down for 1536 feet with its right main gear remaining on the wet grassy mud, about 6-7 feet away from the concrete surface. During this time, the right main gear wheels overran crashing about nine concrete cable laying pits, covered with iron-sheets, each having about 5 feet (length) x 4 feet (width) x 2 feet (depth) dimension. At this time, all the six (6) right main landing gear wheel tires were assumed to have been largely damaged and torn into fragments. The outer rear wheel drum of the right gear was found broken into a few pieces. The right main landing gear of the aircraft, thereafter, with broken wheel rim and devastated tires reverted back on the runway surface.</p> <p>h) The aircraft then rolled down the runway for further about 5000 feet while coming back to the centerline, entered the high speed taxi track (H). The aircraft further rolled down the high speed taxi track for 1440 feet and stopped near the end of the high speed taxi track, short of Southern Taxi Track (S).</p> <p>i) During the whole process of aircraft landing roll, huge amount of wheel debris and brake assembly parts those got detached from the wheel assembly into pieces, were found scattered along the path described by the aircraft covering a large area of runway and grassy mud. Naked wheel rims were found making half to one inch deep cut marks all along on the runway and high speed taxi surfaces covering a distance of about 6500 feet.</p>
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		<p>j) Post occurrence inspection of the aircraft revealed that the entire right wheel well, the surrounding airframe and even the right engine exhaust area were partially and wholly covered with grassy mud.</p> <p>k) The aircraft inspection by the investigating team also observed minor bent to some degrees of the right inner flap of the aircraft with grassy mud deposition around the flap hinges.</p>
3.1.7	Reconstruction of significant portion of the flight path	   
3.1.8	Location (latitude, Longitude, elevation)	N23°51.14' E090 ° 23.20'; Elevation: 24 Ft
3.1.9	Time of the accident (local time or UTC)	0618 UTC
3.1.10	Whether day/night	Day

### 3.2 Injuries to Persons

The flight departed Suvarnabhumi Airport Bangkok, Thailand for Hazrat Shah Jalal International Airport (VGHS), Dhaka, Bangladesh with 02 flight crew, 14 cabin attendants and 154 passengers. The following table indicates the injuries to persons associated with this serious incident:

Para	Injuries	Crew	Passenger	Others
3.2.1	Fatal	None	None	None
3.2.2	Serious	None	None	None
3.2.3	Minor	None	None	None

### 3.3 Damage to Aircraft (Brief description)

Para	Heading	Description
3.3.1	Destroyed	No

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3.3.2	Substantially damaged	<p>a) All the six tyres of the right main landing gear were found partially and/or completely torn and damaged with wheel hubs broken and exposed with entire wheel-well having grass-mud deposition.</p> <p>b) Brake assemblies of a few wheels of the right main landing gear appeared to be torn, damaged and cables are detached from the wheel assembly.</p> <p>c) Minor bent to some degrees of the right inner flap of the aircraft was found with grassy mud deposition around the flap hinges.</p> <p>d) Grassy mud was also observed inside the right engine exhaust areas of the aircraft.</p> <div> </div> <div> </div>
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3.3.3	Slightly damaged	No
3.3.4	Other damage	<p>a) About nine wiring concrete pits of about 5 feet (length) x 4 feet (width) x 2 feet (depth) dimension, lying along the RWY right edge in the grassy mud area, were partially or largely broken and damaged;</p> <p>b) The exposed rims of the broken Tires cut through about 5000 Feet of the RWY surface with 2 Inch X ½ Inch marks.</p>

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### 3.4 Personnel Information

Para	Heading	Description
3.4.1	Pilot information, Pilot in Command (PIC)	Age: 40 years; Nationality: Thai; ATPL: No. D-1939, Valid till 02-03-2021 Ratings: Current on B-777-200/300; Mandatory Checks: Done on 16-07-2018 Flying Experience (Total): 12000Hours. Flying Experience (On type): 11780Hours. Duty time: Rested more than 72Hours prior to this flight. Instructor Rating: No Management Post: No Medical Status: Class-1 till 11-12-2018 CRM training: Done on 02-02-2018
3.4.2	Pilot information, Co-Pilot	Age: 36 years. Nationality: Thai CPL: No. B 4452: Valid Ratings: Current on B-777-200/300 Mandatory Checks: Done on 12-07-2018 Flying Experience (Total): 2,437:51 Hours. Flying Experience (On type): 1,762:53 Hours. Duty time: Rested more than 48 Hours prior to this flight. Flight crew medical status: Class 1 valid till 15-10-2018 Flight crew CRM training: Done on 13-03-2018
3.4.3	Cabin Crew	Not relevant to this investigation.
3.4.4	ATC Controllers (Tower)	Age: 34 years. Nationality: Bangladeshi Employee Identification Number # 20134428 : Issue of Certificate: 06 February 2018 Validity of Certificate: Valid Experience (Total): 05 years. Time of duty: Started at 0130 for 06:30 hrs of shift duty Rest period: Rested more than 12 Hours prior to start of duty.
3.4.5	ATC Controllers (Approach)	Age: 41 years. Nationality: Bangladeshi Employee Identification Number # 20074453 : Issue of Certificate: March 2018 Validity of Certificate: Valid Experience as approach controller: 01 year. Total Experience as controller: 10 years. Time of duty: Started at 0130 for 08:00 hrs of shift duty Rest period: Rested more than 12 Hours prior to start of duty.
3.4.6	Other personnel	Not relevant to this investigation.

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### 3.5 Aircraft information

Para	Heading	Description																																																	
3.5.1	Brief statement on airworthiness and maintenance of the aircraft (indication of deficiencies known prior to and during the flight to be included, if having any bearing on the accident)	<p>a) Thai Airways International Public Co Ltd was issued with AOC No. 03/2017 by CAA Thailand on 08-05-2017 with Expiry Date of 07-05-2022.</p> <p>b) The Aircraft was issued with C of R # 23/2540 by CAA Thailand on 19-12-1996.</p> <p>c) The C of A # 248/2560 of the Aircraft was issued by CAA Thailand on 19-12-2017 with expiry date of 18-12-2020.</p> <p>d) The components of the wheel and tire assemblies, which were damaged by this occurrence, were previously repaired/overhauled as per the following matrix:</p> <table><tr><th>SN</th><th>ITEM</th><th>PART</th><th>SL NO</th><th>ARC* Issued by</th><th>ARC Date</th><th>Work</th></tr><tr><td>1.</td><td>M/W ASSY B777-200ER, 300 (Posn. 03)</td><td>3-1540</td><td>4772</td><td>Thai Airways Intl. Public Co. Ltd.</td><td>14 March 2018</td><td>Repaired</td></tr><tr><td>2.</td><td>Wheel &amp; Tire Assy-MLG B777-200 (Posn. 04)</td><td>3-1533-1</td><td>0703</td><td>Thai Airways Intl. Public Co. Ltd.</td><td>07 Feb 2018</td><td>Repaired</td></tr><tr><td>3.</td><td>Wheel &amp; Tire Assy-MLG B777-200 (Posn. 07)</td><td>3-1553-1</td><td>0697</td><td>Thai Airways Intl. Public Co. Ltd.</td><td>19 Jun 2018</td><td>Repaired</td></tr><tr><td>4.</td><td>Wheel &amp; Tire Assy-MLG B777-200 (Posn. 08)</td><td>3-1553-1</td><td>0704</td><td>Thai Airways Intl. Public Co. Ltd.</td><td>03 Jul 2018</td><td>Repaired</td></tr><tr><td>5.</td><td>Wheel &amp; Tire Assy-MLG B777-200 (Posn. 11)</td><td>3-1553-1</td><td>0699</td><td>Thai Airways Intl. Public Co. Ltd.</td><td>18 May 2018</td><td>Overhauled</td></tr><tr><td>6.</td><td>Wheel &amp; Tire Assy-MLG B777-200 (Posn. 12)</td><td>3-1553-1</td><td>0831</td><td>Thai Airways Intl. Public Co. Ltd.</td><td>17 May 2018</td><td>Overhauled</td></tr></table> <p>*ARC= Authorised Release Certificate.</p> <p>e) As per the maintenance record, the aircraft was issued with CRS (Certificate of Release to Service) # DMK/MW-R/2017_TG18) on 05-08-2017 by the Maintenance Organization of Thai Airways International Public Co Ltd after performing Scheduled Check of C11-CHK+1125D+MOD &amp; Other work.</p> <p>f) As per Aircraft Technical Log, Dated, 24-07-2018, the aircraft was released for flight from Bangkok for Dhaka without any technical defect.</p>	SN	ITEM	PART	SL NO	ARC* Issued by	ARC Date	Work	1.	M/W ASSY B777-200ER, 300 (Posn. 03)	3-1540	4772	Thai Airways Intl. Public Co. Ltd.	14 March 2018	Repaired	2.	Wheel & Tire Assy-MLG B777-200 (Posn. 04)	3-1533-1	0703	Thai Airways Intl. Public Co. Ltd.	07 Feb 2018	Repaired	3.	Wheel & Tire Assy-MLG B777-200 (Posn. 07)	3-1553-1	0697	Thai Airways Intl. Public Co. Ltd.	19 Jun 2018	Repaired	4.	Wheel & Tire Assy-MLG B777-200 (Posn. 08)	3-1553-1	0704	Thai Airways Intl. Public Co. Ltd.	03 Jul 2018	Repaired	5.	Wheel & Tire Assy-MLG B777-200 (Posn. 11)	3-1553-1	0699	Thai Airways Intl. Public Co. Ltd.	18 May 2018	Overhauled	6.	Wheel & Tire Assy-MLG B777-200 (Posn. 12)	3-1553-1	0831	Thai Airways Intl. Public Co. Ltd.	17 May 2018	Overhauled
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3.5.2	Brief statement on performance, if relevant, and whether the mass and centre of gravity were within the prescribed limits during the phase of operation related to the accident. (If not and if of any bearing on the	<p>a) <b>Performance status:</b> As per the readouts of the FDR, there was no abnormality found with regard to take off during departure, en-route, approach and landing at DAC of the aircraft as well as engines.</p> <p>b) <b>Mass and Centre of Gravity:</b> As per the departure Load Sheet of the flight, the following data are acquired and which are within the prescribed limit:</p>																																																	

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# AIRCRAFT ACCIDENT INVESTIGATION GROUP OF BANGLADESH (AAIG-BD)

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## FINAL INVESTIGATION REPORT OF B-777 RUNWAY EXCURSION AT VGHS DHAKA BANGLADESH ON 24-07-2018

	accident give details.)	<div> <div>Total Traffic Load</div> <div>25992 Kg</div> </div> <div> <div>Dry Operating Weight</div> <div>140570 Kg</div> </div> <div> <div>Zero Fuel Weight Actual</div> <div>166562 Kg</div> </div> <div> <div>MAX</div> <div>190508 Kg</div> </div> <div> <div>Take Off Fuel</div> <div>35652 Kg</div> </div> <div> <div>Take Off Weight Actual</div> <div>202214 Kg</div> </div> <div> <div>MAX</div> <div>247207 Kg</div> </div> <div> <div>Trip Fuel</div> <div>13600 Kg</div> </div> <div> <div>Landing Weight Actual</div> <div>188614 Kg</div> </div> <div> <div>MAX</div> <div>201848 Kg</div> </div>
3.5.3	Type of fuel used	JET A-1

### 3.6 Meteorological information

Para	Heading	Description
3.6.1	Brief circumstances including both forecast and actual conditions, and the statement on the meteorological conditions appropriate to the availability of meteorological information to the crew	<p><b>METAR:</b> SW: 260/15 knots; VIS: 2000 Meter; WX: Thundershower with Rain; Cloud: Broken 900 feet; Few CBs: 2500 feet; Overcast 9000 feet; QNH: 1002.9 hpa; Temperature: 27 Degrees C; Dew point: 26 Degrees C; Humidity: 93%;</p> <p><b>SPECI:</b> Was issued at 0605 UTC for Poor Surface Visibility; S/W 230/12 kts; Vis 2000 Mtrs; Present Wx RA, Cloud BKN 900 feet; Few CB 2500 feet; Overcast 9000 feet; QNH 1002.8 hpa; TT 28 degree C; TD 25 Degree C; UU 86%;</p> <p><b>SPECI:</b> Was issued at 0615 UTC for TS; S/W 260/15 kts; Vis 2000 Mtr; Present Wx TSRA, Cloud BKN 900 feet; Few CB 2500 feet; Overcast 9000 feet; QNH 1002.9 hpa; TT 27 degree C; TD 26 Degree C; UU 93%;</p> <p><b>TEMPO:</b> TSRA</p>
3.6.2	Natural light conditions at the time of the accident (sunlight, moonlight, twilight, etc.)	Sunlight but sky was obscured due to moderate to heavy rain.

### 3.7 Aids to navigation

Para	Heading	Description
3.7.1	Pertinent information on navigation aids available, including landing aids such as ILS, MLS, NDB, PAR, VOR, visual ground aids, etc., and their effectiveness at the time	<p><b>NAV Aids:</b> VOR, DME &amp; ILS were serviceable;</p> <p><b>VGA:</b> Precision Approach Path Indicator Lights, Flashing Lights, Threshold Lights, Runway Edge Lights, Centerline Lights, Touchdown Zone Lights and Taxi Lights were available, On and effective.</p> <p><b>Surveillance Radar:</b> Although HISA is equipped with a 'Surveillance Radar' to provide radar vector to aircraft, the Radar does not show the weather phenomenon around, hence least effective for aircraft vectoring during weather buildups.</p>

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#### 3.8 Communications.

Para	Heading	Description																								
3.8.1	Pertinent information on aeronautical mobile and fixed service communications and their effectiveness	<table><tr><th>Service</th><th>Call Sign</th><th>Frequency</th><th>UTC Hours of Operation</th></tr><tr><td>TWR</td><td>Dhaka Tower</td><td>PRI 118.3 MHZ SRY 119.3 MHZ</td><td>H24 H24</td></tr><tr><td>SMC</td><td>Dhaka Ground</td><td>121.8 MHZ</td><td>H24</td></tr><tr><td>APP</td><td>Dhaka Approach</td><td>PRI 121.3 MHZ SRY 120.3 MHZ EMR 121.5 MHZ</td><td>H24 H24 H24</td></tr><tr><td>ACC</td><td>Dhaka Control</td><td>UPR PRI 125.7 MHZ UPR SRY 129.7 MHZ LWR PRI 126.7 MHZ LWR SRY 130.7 MHZ</td><td>1400-0200 0200-1400 0200-1400 0200-1400</td></tr><tr><td>ATIS</td><td>Dhaka Terminal</td><td>127.4 MHZ</td><td>H24</td></tr></table> <ol style="list-style-type: none"><li>1. All Aeronautical Mobile and Fixed Service Communications were functional.</li><li>2. Communications between TG 321 and the air traffic controls of Hazrat Shah Jalal International Airport (VGHS), Dhaka, Bangladesh were normal.</li></ol>	Service	Call Sign	Frequency	UTC Hours of Operation	TWR	Dhaka Tower	PRI 118.3 MHZ SRY 119.3 MHZ	H24 H24	SMC	Dhaka Ground	121.8 MHZ	H24	APP	Dhaka Approach	PRI 121.3 MHZ SRY 120.3 MHZ EMR 121.5 MHZ	H24 H24 H24	ACC	Dhaka Control	UPR PRI 125.7 MHZ UPR SRY 129.7 MHZ LWR PRI 126.7 MHZ LWR SRY 130.7 MHZ	1400-0200 0200-1400 0200-1400 0200-1400	ATIS	Dhaka Terminal	127.4 MHZ	H24
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ATIS	Dhaka Terminal	127.4 MHZ	H24																							

#### 3.9 Aerodrome information

Para	Heading	Description	
3.9.1	Pertinent information associated with the aerodrome, facilities and condition, or with the takeoff or landing area if other than an aerodrome	Name	Hazrat Shah Jalal International Airport (HSIA)
		Location	Dhaka
		Location Indicator	VGHS
		Elevation	8 m (27 ft) AMSL
		Runway Identification	14/32
		Runway Markings	RWY 14/32, Threshold (THR), Touchdown Zone (TDZ), Center Line, RWY Edge and RWY End, Threshold, RWY edge lights
		Taxiway Markings	Centre line, Holding positions at all TWY/RWY intersections marked
		Runway Length, width and slope	3200 m (10500 ft), 45 m (150 ft), and 0%

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		Runway conditions; strength	Asphalt Concrete; PCN 116/F/C/W/T
		Approach and Runway Lighting RWY 14	High intensity flashing light consisting of extended centerline 900 m (Approach); Green (THR); PAPI 3.00°; Runway Centre line light; High intensity, bidirectional raised white amber edge lights (RWY Edge); RED (RWY end) with Stop-way (240 m x 45 m)
		Approach and Runway Lighting RWY 32	Approach light, Green (Threshold), PAPI 3.00°, Centre Line, Bi-directional raised white amber edge lights (RWY edge), Red (RWY end), Stop-way (150 m x 45 m)

### 3.10 Flight recorders

Para	Heading	Description
3.10.1	Location of the flight recorder installations in the aircraft, their condition on recovery and pertinent data available therefrom	<p>a) The Flight data Recorder (FDR) of the aircraft was located at the aft section of the aircraft which has been recovered intact by the investigating team;</p> <p>b) The Cockpit Voice Recorder(CVR) of the aircraft was located at the aft section of the aircraft which has been recovered intact by the investigating team;</p> <p>c) <b>Observations:</b> The recording quality of the FDR data was of good quality. The FDR contained 38 hours and 43 minutes of flight time. The FDR had 1288 parameters in the data frame file. Based on information provided by the operator, Boeing document number D237W018-8 was used to convert the recorder FDR data to engineering units.</p> <p>d) <b>Flight Data:</b> Analysis was performed on the data extracted from the digital flight data recorder.</p> <ol style="list-style-type: none"> <li>Based on the data reviewed, there does not appear to be any technical problems with the aircraft, i.e. all engine related parameters appear to functionally, no Master Caution or Master warning alerts during the Take-Off, Climb, Cruise and Descent phases of flight and the flight control surfaces movements were in line with the inputs provided in the cockpit.</li> </ol> <p>Note: All times are based on UTC. Each sub frame increases by 1 second</p> <ol style="list-style-type: none"> <li>The crew of HS-TJD conducted two approaches into Hazrat Shahjalal International Airport for Runway 14 on 24 Jul 18.</li> <li>At 06:03:57 when the aircraft was approximately 79 ft above ground level (AGL), the first approach was aborted and a go around was executed.</li> </ol>

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**FINAL INVESTIGATION REPORT OF B-777 RUNWAY EXCURSION AT VGHS DHAKA BANGLADESH ON 24-07-2018**

		<ol style="list-style-type: none"><li>4. During the second approach, the autopilot was disconnected at 06:17:08 when the aircraft was 135 ft AGL. The aircraft was configured to Flaps 30, speed brakes armed and all gears down was selected for the approach.</li><li>5. Over the subsequent 9 sec, the following observations were made:<ol style="list-style-type: none"><li>a) Descent rate varied between -992 ft/min to -512 ft/min;</li><li>b) Lateral deviation from the localizer track increased from -0.03 to 0.222 dots (right) just before touchdown;</li><li>c) Wind direction and speed varied from approximately 243 degrees 8.5kts to 296 degrees 8 kts just prior to touchdown.</li></ol></li><li>6. Before touchdown, at 26 ft AGL, the pilot flying provided left rudder and right roll input, consistent with inputs required to de-crab the aircraft.</li><li>7. Just prior to touchdown, the aircraft heading was 144.8 degrees, computed airspeed was 133 kts and -0.222 dots (right) of the localizer track.</li><li>8. The first weight-on-wheel (WOW) ground signals were recorded at 06:17:16 for both the left and the right main gears and the auto speed brake initiated the deployment of the ground spoilers. The nose WOW ground signal was registered two seconds later.</li><li>9. At the first WOW registered, the following was observed:<ol style="list-style-type: none"><li>a) Aircraft pitch angle was +2.2 degrees (nose up)</li><li>b) Aircraft roll angle was +1.23 degrees (right wing down)</li><li>c) Vertical acceleration was +1.39G</li></ol></li><li>10. On landing, the aircraft appeared to have skidded towards the right edge of the runway based on the following observations:<ol style="list-style-type: none"><li>a) Recorded lateral acceleration values reached +0.29G (right).</li><li>b) Aircraft heading decreased from 144 to 136 degree</li><li>c) Drift angle varied between +8.26 to +1 degree (clockwise)</li></ol></li><li>11. Approximately 2.5s after touchdown, both thrust reversers were deployed for 5.7s before it was momentarily stowed for 1s before it was re-deployed for another 14s before it was re-stowed.</li><li>12. During the rollout sequence, it was observed that:<ol style="list-style-type: none"><li>a) The maximum recorded localizer deviation value was -0.519 dots (right), consistent with the ground observation that the aircraft veered off the right edge of the runway.</li></ol></li></ol>
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		<p>b) The PF applied only left rudder inputs with the recorded rudder pedal positions reaching 25.7679 inches (left rudder pedal forward).</p> <p>13. At 06:17:53, 36s after the initial touchdown, the localizer deviation decreased to almost 0 dots suggesting that the aircraft responded to the PF's left rudder input to re-enter the paved surface of the runway and eventually travelled along the centerline of the runway.</p> <p>14. The last recorded groundspeed was 0 kt and heading was 54.49 degrees, consistent with the aircraft stopping at the High Speed exit taxiway.</p> <p>15. The flight data recorder and cockpit voice recorder stopped recording at 06:26:26 and 08:14:15 respectively.</p> <p>16. It should be noted that tyre pressure and tyre temperature parameters were not recorded the FDR. Correspondingly, no assessment could be made on the condition of the tyres prior and during the occurrence.</p> <p>e) <b>Cockpit Voice Recorder:</b> The CVR which could record voice data for duration of two (2) hours only provided cockpit and ATC conversation together with other sound signals for a small duration. The only data available with regard to the occurrence was of the aircraft's second approach from its final approach path until it stopped on the High Speed taxi track. The aircraft power was kept ON by the flight crew for a long duration while the aircraft was on the High Speed taxi track that resulted some of the valuable information, that could be extracted during the aircraft first approach to land, was erased due to overlapping recording.</p>
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### 3.11 Wreckage and impact information

Para	Heading	Description
3.11.1	General information on the site of the accident and the distribution pattern of the wreckage, detected material failures or component malfunctions. Details concerning the location and state of the different pieces of	The AAIT believes that the aircraft touched down short of the RWY Touch Down Zone and on to the right half of the RWY centerline. According to the photographic evidence, indicated underneath, the right outbound rear wheel might have burst immediately after the touched down and on impact with the RWY surface. This might have made a tendency for the aircraft to veer slightly to the right resulting the right wheel assembly to go outside the RWY edge into wet grassy mud. None the less, it cannot be ruled out that the huge mass of the aircraft which veered slight right into the wind near the threshold might have brought-in inertial force resulting the aircraft to veer further right into the grassy area. According to the DFDR read out, the PIC applied the left rudder immediately after touch down to bring the aircraft back to centerline. While the aircraft continued to roll with its right wheels on the muddy surface, the wheels went over about nine (09) concrete cubical pits of about 5 feet (length) x 4 feet (width) x 2 feet (depth) dimension, that resulted the rupturing and bursting of at least four of the six wheels of the right landing gear.

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	<p>the wreckage are not normally required unless it is necessary to indicate a break-up of the aircraft prior to impact. Diagrams, charts and photographs may be included in this section or attached in the appendices</p>	 	
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#### 3.12 Medical and pathological information

Para	Heading	Description
3.12.1	Brief description of the results of the investigation undertaken and pertinent data available therefrom	There was no evidence of any medical abnormality found of the pilots of TG 321.

#### 3.13 Fire

Para	Heading	Description
3.13.1	If fire occurred, information on the nature of the occurrence, and of the firefighting equipment used and its effectiveness	There was no evidence of fire at any stage of the occurrence.

#### 3.14 Survival aspects

Para	Heading	Description
3.14.1	Brief description of search, evacuation and rescue, location of crew and passengers in relation to injuries sustained, and failure of structures such as seats and seat-belt attachments	<ol style="list-style-type: none"> <li>Neither any passenger nor any crew sustained any injury as a result of this occurrence.</li> <li>All passengers and crew were disembarked by stairs.</li> </ol>

#### 3.15 Tests and research

Para	Heading	Description
3.15.1:	Brief statements regarding the results of tests and research	<ol style="list-style-type: none"> <li>The DFDR and the CVR have been decoded and analyzed in TSIB Facility in Singapore and the report of analysis thereto have been outlined in Para 3.10.</li> <li>The wheel tires could not be investigated due to lack of appropriate</li> </ol>

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		facilities. However, the AAIT has requested Thai to conduct the same if feasible in Thailand.
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**3.16 Organizational and Management information**

Para	Heading	Description
3.16.1	Pertinent information concerning the organizations and their management involved in influencing the operation of the aircraft. The organizations include, for example: the operator; the air traffic services; airway, aerodrome and weather service agencies; and the regulatory authority. The information could include, but not be limited to, organizational structure and functions, resources, economic status, management policies and practices, and regulatory framework	<p>Thai Airways International Public Company Ltd has been a regular schedule operator which conducts one to two flights from Bangkok to Dhaka since long time.</p> <p>The flight was uneventful until it made the first ILS approach for RWY 14 at Hazrat Shah Jalal International Airport, Dhaka. The weather around Dhaka airport was rain with thunderstorm with reduced visibility around the approach path.</p>

**3.17 Additional information**

Para	Heading	Description
3.17.1	Relevant information not already included in 3.1 to 3.16	Nil

**3.18 Useful or effective investigation techniques**

Para	Heading	Description
3.18.1	When useful or effective investigation techniques have been used during the investigation, briefly indicate the reason for using these techniques and refer here to the main features as well as describing the results under the appropriate subheadings 3.1 to 3.17	<p>The AAIT performed following procedure during the course of investigation:</p> <ol style="list-style-type: none"> <li>Visited the Crash site to observe the wreckage and took evidences as applicable;</li> <li>Visited Aerodrome Control Tower, Approach and Area control centre;</li> <li>Collected ATC- Pilot Records and prepared Transcripts;</li> <li>Necessary Engineering and Operations documents were collected from Thai Airways;</li> <li>Collected CVR and FDR, which were accompanied by the IIC to TSIB Singapore for downloading, decoding and analyzing data including animation;</li> <li>Collected the weather information of the time of occurrence;</li> <li>Taken Statements and Interviewed both the flight crew;</li> <li>Interviewed concerned ATC Officers, and senior officials from the HSIA;</li> <li>Upon examining all components, such as the CVR, DFDR, ATC Transcript, Photographs, Interview of personnel, documents and available information, the AAIT analyzed in minute detail the contributing factors and probable cause of the serious incident to prepare this final draft report.</li> </ol>

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**FINAL INVESTIGATION REPORT OF B-777 RUNWAY EXCURSION AT VGHS DHAKA BANGLADESH ON 24-07-2018****4. ANALYSIS**

[The following analysis has been made based on the information documented in ‘**Factual information**’ and which is relevant to the ‘**Determination of Conclusions**’ and ‘**Causes and/or Contributing Factors**’]

Para	Heading	Description
4.1	Man	<p><b>A. Flight crew</b></p> <p>a) Human involvement for this serious incident was that of only the two flight crews, the PIC and the FO, associated with this flight. Both the flight crews were rated and there was no evidence of their any disqualification associated with this occurrence. Both the flight crews were physically sound, well-rested and medically fit to operate the flight;</p> <p>b) The FO was the Pilot flying for the first time when missed approach was carried out as the flight crew could not establish visual contact with the RWY during its ILS approach for RWY 14 at HSIA, Dhaka due to poor visibility as a result of passing thundershower and moderate rain.</p> <p>c) Almost immediately after commencing the missed approach, the aircraft was on radar vector and thereafter was positioned for the second ILS approach for RWY 14 as intended by the flight crews. This time the PIC made the ILS approach for RWY 14. The aircraft was flown with Autopilot (AP) and the flight until intercepted the ILS for RWY 14 was uneventful as indicated by the analysis of the DFDR.</p> <p>d) The CVR indicated that the PIC discussed with the FO to disconnect the AP at low altitude to ensure that the AP flies the aircraft alike a precision approach while being at the centerline of the RWY.</p> <p>e) While the visibility remained marginal, but above the limiting bracket, the aircraft, according to the DFDR readout, flew perfectly towards the centerline with a minor d-crab, catering for the incoming wind of speed 8-8.5 kts from the right. According to the deliberation by the flight crews and the DFDR &amp; CVR analysis, it was revealed that the RWY was sighted by the PIC and followed by the FO just prior to Minima at 135-145 feet AGL. Soon after, he PIC disconnected the AP at 135 feet AGL and started flying the aircraft manually. Although landing clearance was given by the tower controller, there was no response from the aircraft for landing. Furthermore, the tower controller asked if the flight crews have sighted the RWY, but there was no response from the flight crews</p> <p>f) The PIC flew the aircraft manually in order to maintain its d-crab profile for a while and thereafter to align the aircraft properly with the RWY centerline with the aircraft right wing slightly dipped down to cater for the cross wind and simultaneously applying the left rudder to counteract the aircraft drift. During this process, the aircraft went slightly below the glide slope with its longitudinal axis remaining about 5 degrees starboard of the RWY longitudinal axis.</p>

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		<p>Apparently, the rearmost outer wheel of the right landing gear touched the RWY surface well short of the RWY touch down zone and on to the right edge of the RWY veering the aircraft to right towards the right RWY edge and even beyond.</p> <p>Once the right landing gear of the aircraft with its all six wheels were on the grassy mud, most damages to the wheels took place due to hitting the concrete pits. At least four out of six tires were fragmented into many pieces, the outer rearmost wheel rim got broken and considerable damage occurred to the whole wheel and associated brake assemblies.</p> <p>g) While interrogating the flight crews, the investigation team learnt that although the pilots appreciated that the aircraft landed on the right edge of the RWY, neither of the flight crew could appreciate that the right main landing gear of the aircraft left the concrete surface and rolled along the muddy surface and thereafter overran nine pits causing severe damages to the wheels. It was only when the aircraft came out of the grassy mud, on to the concrete surface again with bare and broken rim cutting the RWY surface and the aircraft was juddering mildly, the FO realized and advised PIC that the aircraft right wheel tires may have given up (burst).</p> <p>h) The Investigation Team, hereby analyses that the Pilot action by the PIC immediately after disconnecting the AP was not adequately coordinated to ensure that the aircraft touches down approximately at the 'touchdown zone' and as close to the centerline of the RWY as possible.</p> <p>i) The Investigation Team also noted that following a missed approach at the first approach, the flight crew, rather rapidly, initiated the second approach, which could have been delayed for the weather to clear up and thereafter, landing could be made in an improved weather condition.</p> <p><b>B. Tower Controller</b></p> <p>a) The runway excursion by TG 321 was not noticeable by the tower controller due to restricted visibility. After TG 321 had landed, the tower controller gave usual changeover of frequency to ground control without having known that TG 321 had a runway excursion. It was after another aircraft (Jet Airways 276 – Boeing 738) that made the follow up landing within two minutes after the landing of TG 321, reported to the tower control about the location of scattered debris on the right edge of the RWY.</p> <p>b) The tower controller immediately sent the inspection vehicle for RWY inspection and ascertained that TG 321 had a runway excursion. Thereafter, the tower controller took the necessary measures regarding sending the fire vehicles and ambulances, as applicable, to the high speed taxi track where TG 321 had stopped following the runway excursion.</p> <p><b>C. Approach Controller</b></p>
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		<ol style="list-style-type: none"><li>Initially TG 321 was provided radar vector by the approach controller who handed over to tower controller at 0600:31 UTC when the aircraft reported to have established ILS for RWY 14;</li><li>After TG 321 made missed approach, the tower controller handed over the aircraft to the approach controller at 0604:32 UTC. TG 321 reported to the Approach Controller about his 'Go around' and requested radar vector for second approach. Thereafter the approach controller requested TG 321 to climb to 3000 feet and provided radar vector for the second approach to ILS RWY 14. Once the aircraft reported to have established ILS for RWY 14, the approach controller handed over the aircraft to the tower controller at 0614:35 UTC;</li><li>When questioned by the investigating team to the approach controller, based on the experience of the later, if it would have been sensible to ask TG 321 to hold under radar vector for some time for the weather to dissipate or move away as the successive approach was attempted too quickly, the approach controller replied, "Yes it might have been sensible but TG 321 had already requested for the second approach following the missed approach".</li></ol>
4.2	Machine	There was no issue with the serviceability of aircraft. Also there was no mechanical unserviceability of the aircraft. The Technical Logbook did not depict any un-serviceability regarding the airworthiness status of the aircraft including the landing gears and the wheels.
4.3	Environment	<ol style="list-style-type: none"><li>During the time of approach and landing, the weather was rain with thundershower and the RWY surface was wet. There was cross wind of about 8 knots from the right that hardly made any significant difference to aircraft flight path;</li><li>It was observed that there was increased risk of damage to the aircraft from striking a hard vertical surface (the isolation transformer concrete pits for runway lighting system) being close to the runway shoulder.</li><li>The manholes/handholds having the dimension of about 5 feet (length) x 4 feet (width) x 2 feet (depth) were found having sharp vertical edges which remained protruded above the ground surface by about 4-6 inches may have ruptured the tire wheels of the right landing gear one after another when rolled over those at high speed.</li></ol>
4.4	Organizational Aspect	Non-contributing to this serious incident.

**5. CONCLUSIONS**

[Listed in the following sections are the findings, causes and/or contributing factors established in the investigation. The list of causes and/or contributing factors include both the immediate and the deeper systemic causes and/or contributing factors]

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**FINAL INVESTIGATION REPORT OF B-777 RUNWAY EXCURSION AT VGHS DHAKA BANGLADESH ON 24-07-2018****6. FINDINGSS**

Para	Heading	Description
6.1	Aircraft	Aircraft was airworthy and serviceable in all respects. There was no issue in this occurrence with regard to aircraft. However, the accident investigation team would like to mention that, major damages to the right main landing gear wheels took place as a result of them (right main landing gear wheels) hitting, one after another, the nine manholes/handholds having the dimension of about 5 feet (length) x 4 feet (width) x 2 feet (depth) which had sharp vertical edges protruding above the ground surface by about 4-6 inches.
6.2	Flight Crews	Both the flight crews were rated and there was no evidence of their any flight crew disqualification associated with this occurrence. Both the flight crews were physically sound, well-rested and medically fit to operate this flight;
6.3	Flight Operations	<p>a) The FO was the Pilot flying for the first time when missed approach was carried out as the flight crew could not establish visual contact with the RWY during its ILS approach for RWY 14 at HSIA, Dhaka due to poor visibility as a result of passing thundershower and moderate rain.</p> <p>b) The PIC made the second ILS approach for RWY 14. The aircraft was flown with Autopilot (AP) and the flight until intercepted the ILS for RWY 14 was uneventful.</p> <p>c) The PIC discussed with the FO to disconnect the AP at low altitude to ensure that the AP flies the aircraft alike a precision approach while being at the centerline of the RWY.</p> <p>d) The RWY was sighted by the PIC and followed by the FO at or around 135-145 feet AGL. Soon after, he PIC disconnected the AP at 135 feet AGL and started flying the aircraft manually.</p> <p>e) Although landing clearance was given by the tower controller, there was no response from the aircraft for landing. Furthermore, the tower controller asked if the flight crews have sighted the RWY, but there was no response from the flight crews</p> <p>f) The PIC flew the aircraft manually in order to maintain its d-crab profile for a while and thereafter to align the aircraft properly with the RWY centerline with the aircraft right wing slightly dipped down to cater for the cross wind and simultaneously applying the left rudder to counteract the aircraft drift. During this process, the aircraft went slightly below the glide slope with its longitudinal axis remaining about 5 degrees starboard of the RWY longitudinal axis.</p> <p>g) The flight crews appreciated that the aircraft landed on the right edge of the RWY, but could not appreciate that the aircraft right main landing gear had gone out of the RWY and was rolling on the muddy surface, even it overran nine pits. However, when the aircraft came out of the grassy mud, on to the concrete surface again with bare and broken rim cutting the RWY surface and the aircraft was juddering mildly, the flight crews realized that the aircraft right wheel tires gave up</p>

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**FINAL INVESTIGATION REPORT OF B-777 RUNWAY EXCURSION AT VGHS DHAKA BANGLADESH ON 24-07-2018**

		(burst).
6.4	Operator	The operator uses Retread Tire in the aircraft. Presumably, the right main landing gear wheel tires failed to sustain the shocks that resulted major damages after hitting, one after another, the nine manholes/handholds having the dimension of about 5 feet (length) x 4 feet (width) x 2 feet (depth) which had sharp vertical edges protruding above the ground surface by about 4-6 inches.
6.5	ATC	Not contributory to this occurrence.
6.6	CVR, FDR & ATC Transcript	All the three items were securely taken under the custody of the investigation team. The readouts and analysis were conducted uneventfully. The investigation analysis has been done by taking into considerations the outputs received from all three.

## 7. CAUSES

The cause of the serious incident was due to '**Human Factor**', wherein,

- a) The flight crew's inadequate coordination during manual handling of the aircraft while approach to land resulted the aircraft neither touch down within the 'touchdown zone' nor at or close to the centerline of the RWY due to inappropriate alignment with the RWY; and,
- b) According to the DFDR read out, the PIC applied the left rudder immediately after touch down to bring the aircraft back to centerline. The PIC provided left rudder input for a duration of approximately 19.6s, reaching a peak recorded value of 25.7679 inches (left rudder pedal forward). However, either, the left rudder pedal input was insufficient or, there were requirement to use left wheel brakes also (which was not applied initially) to prevent the aircraft from veering off the right edge of the runway due to inertia.

## 8. CONTRIBUTING FACTORS

### a) Human factor:

1. Flight crew decision not to hold around the vicinity of the airfield for the weather to clear off and thereafter commence the second approach for landing; and,
2. Flight crew decision, not to go around the second time;

### b) Weather factor:

1. Reduced visibility due to rain and thundershower during the approach time; and,
2. Slant visibility restricted pilot vision to sight the RWY late;

### c) Maintenance factor:

The right main landing gear tires being Retread may not have sustained the shocks resulting major damages after hitting, one after another, the nine manholes/handholds.

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**FINAL INVESTIGATION REPORT OF B-777 RUNWAY EXCURSION AT VGHS DHAKA BANGLADESH ON 24-07-2018****d) Aerodrome Factor:**

1. It was observed that there was increased risk of damage to the aircraft from striking a hard vertical surface (the isolation transformer concrete pits for runway lighting system) being close to the runway shoulder.
2. Many (in excess of nine) manholes/handholds, located too close to the RWY edge, having the dimension of about 5 feet (length) x 4 feet (width) x 2 feet (depth) with sharp vertical edges protruding above the ground surface by about 4-6 inches adversely contributed towards causing heavy damage to the tires when the aircraft rolled over those at high speed.

**9. INTERMEDIARY SAFETY RECOMMENDATIONS**

There was no Intermediary Safety Recommendation issued in relation to this serious incident

**10. SAFETY RECOMMENDATIONS**

The Accident Investigation Team would like to outline the following as the **Safety Recommendations** for the Serious Incident:

**a) Flight crew training (in Simulator) should emphasize to include the following:**

1. Landing with cross wind component, rain, thundershower, poor visibility condition and wet runway surface;
2. Piloting technique while manual flying with cross wind component, rain, thundershower, poor visibility condition yet making the landing near about the 'touchdown zone' and centerline of the RWY;
3. Pilot decision making whether or not to commence approach in marginal weather condition; and,
4. To 'Go around', any time, if felt not comfortable, during approach and landing.

**b) Radar Equipment at HSIA:** Radar Service of HSIA should be upgraded so that the Radar equipment can show the weather phenomenon around for aircraft vectoring by the approach controllers during weather conditions;**c) Maintenance:** The reliability program of the operator should monitor the in-service reliability of the Retread Aircraft Tires.**d) Aerodrome Operator of HSIA:** The aerodrome operator should consider locating and designing drains or any other underground electrical systems installation particularly for those to be installed with concrete encasement, manholes and handholds by chambering or tapering design of the edge of those and/or locating those as far as practicable from the edge of runway.**11. APPENDICES**

All evidences, data recordings, documents, photographs etc. have been systematically stored in file.

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