FINAL REPORT ON ACCIDENT INVOLVING BOEING 737-800 AIRCRAFT VT-GHE OPERATED BY M/s AIR INDIA EXPRESS AT VIJAYAWADA AIRPORT ON 20TH FEB 2021.

KUNJ LATA

INVESTIGATOR-IN-CHARGE

AMIT KUMAR

INVESTIGATOR

FOREWORD

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2017, the sole objective of the investigation of an accident shall be the prevention of accidents and incidents and not to apportion blame or liability.

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts and ATC recordings. Consequently, the use of this report for any purpose other than for the prevention of future accidents or incidents could lead to erroneous interpretations.

ABBREVIATIONS

AAIB	Aircraft Accident Investigation Bureau
APP	Approach Control
ATC	Air Traffic Controller
ATPL	Airline Transport Pilot License
CPL	Commercial Pilot License
DFDR	Digital Flight Data Recorder
ICAO	International Civil Aviation Organization
NM	Nautical Miles
PF	Pilot Flying
PM	Pilot Monitoring
UTC	Co-ordinated Universal Time
VHF	Very High Frequency

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FINAL REPORT ON ACCIDENT INVOLVING BOEING 737-800 AIRCRAFT VT-GHE OPERATED BY M/S AIR INDIA EXPRESS AT VIJAYAWADA AIRPORT ON 20TH FEB 2021.

1.	Aircraft Type	BOEING 737-800
2.	Nationality	INDIAN
3.	Registration	VT-GHE
4.	Owner	M/s AIR INDIA EXPRESS
5.	Operator	M/s AIR INDIA EXPRESS
6.	Pilot – in –Command	ATPL
	Extent of Injuries	NIL
7.	Co-Pilot	CPL
	Extent of Injuries	NIL
8.	Place of Accident	VIJAYWADA AIRPORT
9.	Co-ordinates of Accident Site	Lat: 23°45'23" N Long: 78°51'25" E
10.	Last point of Departure	DOHA
11.	Intended place of Landing	VIJAYWADA
12.	Date & Time of Accident	20th February 2021 at 1123 UTC
13	Persons on Board	70
14.	Extent of Injuries	NIL
15.	Phase of Operation	TAXI
15.	Type of Occurrence	ACCIDENT
(ALL TIMINGS IN THE REPORT ARE IN UTC)		

SYNOPSIS

On 20th February 2021, M/S Air India Express Limited (Type: Boeing 737-800 Registration: VT-GHE) , after landing at Vijayawada Airport met with an accident while taxing to parking bay.

The aircraft was scheduled to operate its flight from Tiruchirappalli - Doha – Vijayawada. It was under the command of an ATPL holder, who was Pilot flying (PF). PF was assisted by a CPL holder, who was the Pilot Monitoring (PM) for Doha- Vijayawada sector. The flight was uneventful till landing

While taxing to stand, aircraft right wing leading edge hit flood light mast thereby damaging leading edge of slat no 7 & 8. Due to hit by the aircraft right wing, flood light mast broke and fell on the ground.

Director General, AAIB appointed Sh. Kunj Lata, Assistant Director, AAIB as Investigator – In – Charge & Sh. Amit Kumar, Safety Investigator Officer, AAIB as Investigator to investigate into the probable cause(s) of the accident, vide Order No. INV.11011/1/2021-AAIB dated 22nd Feb 2021 under Rule 11 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017.

1.0 FACTUAL INFORMATION

1.1 History of the flight

On 20th February 2021, Boeing 737-800 aircraft (Call Sign: AXB1676 Registration: VT-GHE) of M/S Air India Express Limited was Scheduled to operate its flight from Tiruchirappalli - Doha – Vijayawada.

Both crew reported for duty almost an hour prior to flight at Tiruchirappalli. Pre-flight BA test was negative.

First sector i.e. Tiruchirappalli to Doha was uneventful. At 0711 UTC, Aircraft took off from Doha for Vijayawada. Aircraft was under the command of an ATPL holder, who was Pilot Flying (PF) and was assisted by a CPL holder, who was Pilot Monitoring (PM) for this sector.

At Vijayawada, ATC cleared the aircraft for landing and landing was uneventful on Runway 08. After landing ATC instructed the aircraft "*Back track runway 08, vacate via A bay No. 04*". Accordingly aircraft back tracked. During taxi, as per AAI Regional Headquarters instructions in vogue ATC inquired with crew as "*Report Number of pax and Crew*". Crew replied "*64 passengers and 06 crew*". Tower controller enquired as, "*78 confirm*". Crew transmitted again "*64 passengers and 06 crew*". Tower controller acknowledged "*Total 70 copied*".

After entering taxiway A, PF appeared confused and enquired the same with PM about the assigned right turn for parking bay. At that moment PM was also confused. The marking at the apron were faded. However, the

PF had turned the aircraft toward its right and the aircraft was taxing slowly. Consequently, aircraft right wing hit one of the flood light mast at apron.

While taxing, at 11:23:24 UTC, aircraft informed controller "*We are on wrong taxiway I think we have hit the one of the taxi lights. We want to hold the present position*". ATC permitted the same.

Aircraft RH wing leading edge slat no 7 & 8 got damaged, due to hit by flood light mast which broke and fell on the ground. There was no post-accident fire and injuries to any person on board.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor/None	Nil	Nil	Nil

1.3 Damage to the Aircraft

Post-accident maintenance :

1. Damage assessment was carried out by the Structure AME in addition to B1 and B2 AME to ascertain the extent of Damage. Following damages were found:

i. Aircraft RH wing Slat #7 & Slat# 8 found damaged.

ii. Slat #7 Seal rib area was found cracked. Outboard end was found torn with 6” long, 305” wide and 0.75” deep dent.

iii. Slat# 8 inboard end Aluminum nose skin curved cove skin both were found cracked. Approx. 27” long and 17” wide skin portion of Slat#8 was found torn.

iv. Three Leading Edge access panels were found damaged.

v. Slat#8: wing outboard fixed leading edge upper skin panel was found damaged.

2. On OEM instructions, additional inspection were carried out to ensure the integrity of main structures such as wings and fuel tanks. Nil discrepancies were observed.

1.4 Other Damages

A flood light mast was found to be damaged as shown in the figure below.

1.5 Personnel Information

1.5.1 Pilot-in-command (PF at the time of occurrence)

Nationality	INDIAN
Date of Joining to the Organization	24 Nov 2004
Age	43 years
License	ATPL
Date of Issue/ Validity	08 Feb 2008 / Valid
Category	Aeroplane
Date of Class I Med. Exam/ Validity	22 Jan 2021/ Valid
Date of issue FRTOL License/ Validity	23 Jul 2001/ Valid
Endorsements as PIC	B 737-800, King Air C-90, TB-20
Total flying experience	4100:19 Hrs
Total flying experience on type	8500:00 Hrs

Total flying experience during last 1 year	259:25 Hrs
Total flying experience during last 6 Months	205:05 Hrs
Total flying experience during last 30 day	69:21 Hrs
Total flying experience during last 07 Days	18:14 Hrs
Total flying experience during last 24 Hours	09:02 Hrs
Rest period before flight	23:49 Hrs
Whether involved in Accident/Incident earlier	No
Date of latest Flight Checks and Ground Classes	Annual Ground Recurrent- 02 Nov 2020 to 06 Nov 2020 Annual Line Check – 16 Mar 2020

1.5.2 Co-Pilot (PM at the time of occurrence)

Nationality	INDIAN
Date of Joining to the Organization	29 Dec 2017
Age	29
License	CPL
Date of Issue/ Validity	21 Apr 2016 / Valid
Category	Aeroplane
Date of Class I Med. Exam / Validity	18 Dec 2020/ Valid
Date of issue FRTOL License/ Validity	21 Apr 2016
Endorsements as PIC	CA 172, DA 42
Total flying experience	1605:26 Hrs
Total flying experience on type	1800:00 Hrs
Total flying experience during last 1 year	390:11 Hrs
Total flying experience during last 6 Months	253:51 Hrs
Total flying experience during last 30 days	48:51 Hrs
Total flying experience during last 07 Days	17:24 Hrs

Total flying experience during last 24 Hours	09:02 Hrs
Rest period before flight	22:34 Hrs
Whether involved in Accident/Incident earlier	No
Date of latest Flight Checks and Ground Classes	Annual Ground Recurrent- 14 Dec 2020 to 17 Dec 2020 Annual Line Check – 15 Aug 2020

1.5.3 Air Traffic Controller

License	ADC/APP(Procedural) combined
Date of Issue	26-12-2019
Validity	25-12-2045
Endorsements	Aerodrome control Approach control Procedural rating of Vijayawada airport
Medical Validity	19-01-20222
Date of Last Proficiency Check (Channel and date)	28-09-2020
Involved in Accident/Incident in Past	NIL
Last Duty Performed	20-02-2021
Fatigued Factor	NIL

1.6 Aircraft Information

1.6.1 General

Boeing 737-800 Aircraft Description:

Boeing B737-800 is a subsonic, medium-range, civil transport aircraft. The aircraft is installed with two high bypass turbo fan engines manufactured

by International Aero Engines. The aircraft is designed for operation with two pilots and has passenger seating capacity of 189. The aircraft is certified in Normal (Passenger) category, for day and night operation under VFR & IFR. The maximum take-off weight is 79015 Kgs. The Maximum Landing weight is 65317 Kgs.

The Aircraft length is 39.472 meters, wingspan is 35.8 meters and height is 12.459 meters. The distance between main wheel centers is 5.715 meters. The Ground Clearance is 0.53 meters.

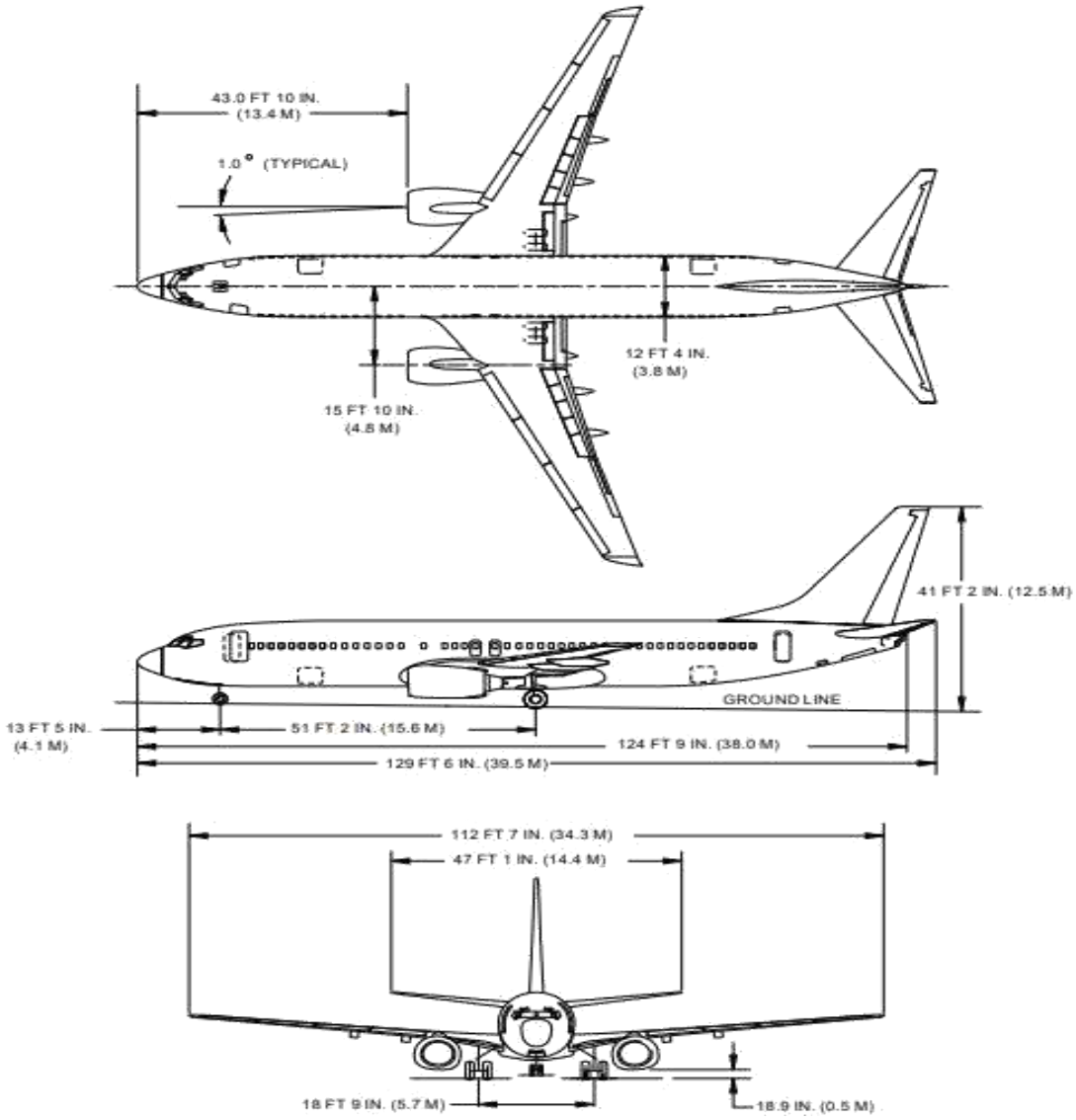

Figure: Three View diagram of Boeing 737-800 aircraft

1.6.2 Aircraft details (VT-GHE)

Aircraft Model	B737-800
Aircraft S. No.	60698
Year of Manufacturer	2016
Name of Owner	M/S. CELESTIAL AVIATION TRADING 64 LTD
C of R	26.10.2017
C of A	14.10.2016
Category	COMMERCIAL AIR TRANSPORT
C of A Validity	UNLIMITED
A R C issued on	12.10.2020
ARC valid up to	13.10.2021
Aircraft Empty Weight	41554.92 kgs
Maximum Takeoff weight	79015 kgs
Date of Aircraft weighment	24-Sep-2016
Empty Weight	41554.92 kgs
Max Usable Fuel	21340.17 kgs
Max Payload with full fuel	15120.01 kgs
Empty Weight C. G	660.897 inches from Datum
Next Weighing due	23-Sep-2021
Total Aircraft Hours	17556
Last major inspection	PH-36 carried out on 27-02-2020 (15487 FH)
Engine Type	CFM56-7B27E
Date of Manufacture LH	27 SEP 2016
Engine Sl. No.1 (LH)	864559
Last major inspection (LH)	Nil
List of Repairs carried out after last major inspection till date of incidence	N/A
Total Engine Hours/Cycles LH	17556 & 5341

1.7 Meteorological Information

Time in UTC	Wind Dir/Speed (degree/kt)	Vis (m)	Clouds	Temp (℃)	DP (℃)	QNH (hPa)	TREND
1101	070/15 Gusting: 15	4000	SCT 020 FEW030 CB BKN 100	28	10	1012	No SIG
1131	070/15 Gusting: 25	4000	SCT 020 FEW030 CB BKN 100	28	10	1013	No SIG

1.8 Aids to Navigation

All available navigational aids at Vijayawada Airport were operational.

1.9 Communication

Positive two way communications between the ATC and aircraft was always maintained. Relevant portion of tape transcript of Tower (118.55 Mhz) is appended below:-

TIME	FROM	TO	TEXT
11:16:18	TOWER	AXB1676	ROGER RUNWAY ZERO EIGHT CLEARED TO LAND WIND ZERO SEVEN ZERO DEGREES ONE ZERO KNOTS GUSTING TWO ZERO KNOTS
11:16:25	AXB1676	TOWER	CLEARED TO LAND RUNWAY ZERO EIGHT AXB1676
11:19:13	TOWER	AXB1676	LANDED ONE NINE BACKTRACK RUNWAY ZERO EIGHT VACATE VIA ALPHA BAY NUMBER FOUR
11:19:20	AXB1676	TOWER	BACKTRACK RUNWAY ZERO EIGHT VACATE VIA ALPHA BAY FOUR AXB1676 GOLF HOTEL ECHO
11:21:18	TOWER	IGO7205	ROGER CONTINUE MINIMUM APPROACH SPEED TO ACCOMMODATE DEPARTURE COMPANY

11:21:36	TOWER	IGO7247	CLEARANCE CLEARED TO TIRUPATI VIA FLIGHT PLANNED ROUTE FLIGHT LEVEL ONE FIVE ZERO DEPARTURE RUNWAY ZERO EIGHT TURN RIGHT PROCEED DIRECT TANGO TANGO PAPA SQUACK ZERO TWO ONE FOUR
11:21:49	IGO7247	TOWER	CLEARED TO TIRUPATI FLIGHT PLANNED ROUTE FLIGHT LEVEL ONE SEVEN ZERO AFTER DEPARTURE TURN RIGHT PROCEED DIRECT TANGO TANGO PAPA SQUACK ZERO TWO ONE FOUR IGO7247
11:22:11	TOWER	AXB1676	REPORT NUMBER OF PAX AND CREW
11:22:16	AXB1676	TOWER	SIX FOUR PASSENGERS ZERO SIX CREW
11:22:20	TOWER	AXB1676	SIXTY EIGHT CONFIRM
11:22:25	AXB1676	TOWER	SIXTY FOUR PASSENGERS AND SIX CREW
11:22:28	TOWER	AXB1676	TOTAL SEVENTY COPIED
11:22:52	TOWER	AXB1676	AXB1676
11:23:03	IGO7205	TOWER	ESTABLISHED FINAL APPROACH TRACK RUNWAY ZERO EIGHT IGO7205
11:23:13	TOWER	IGO7247	RUNWAY ZERO EIGHT CLEARED FOR TAKEOFF WIND ZERO SEVEN ZERO DEGREES ZERO EIGHT KNOTS
11:23:20	IGO7247	TOWER	CLEARED FOR TAKE OFF IGO7247
11:23:24	AXB1676	TOWER	WE ARE ON WRONG TAXIWAY I THINK WE HAVE HIT THE ONE OF THE TAXILIGHTS WE WANT TO HOLD THE PRESENT POSITION
11:23:33	TOWER	AXB1676	HOLD POSITION
11:23:53	AXB1676	TOWER	ATC CAN WER SWITCH OFF OUR ENGINES NOW
11:23:56	TOWER	AXB1676	STANDBY STAND BY
11:24:16	TOWER	IGO7205	RUNWAY ZERO EIGHT CLEARED TO LAND WIND ZERO SEVEN ZERO DEGREES ONE ZERO KNOTS GUSTING TWO ZERO KNOTS
11:24:23	IGO7205	TOWER	COPIED CLEARED TO LAND RUNWAY ZERO EIGHT IGO7205
11:24:39	TOWER	AXB1676	GOHEAD
11:24:41	AXB1676	TOWER	WE HAVE SHUTDOWN OUR ENGINES STANDING BY PRESENT POSITION WE ARE ON THE RIGHT EXIT TAXI NOT LANE IT WAS ON THE TAXI LIGHTS
11:24:54	TOWER	AXB1676	CONFIRM YOU ARE CLEAR OF TAXIWAY ALPHA
11:24:56	AXB1676	TOWER	WE ARE CLEAR OF TAXIWAY ALPHA WE HAVE TURNED RIGHT

11:25:00	TOWER	AXB1676	ROGER
11:25:02	AXB1676	TOWER	WE ARE NEAR TO BAY TWELVE
11:25:05	TOWER	AXB1676	ROGER
11:25:09	TOWER	AXB1676	CONFIRM ANY EQUIPMENT REQUIRED FOR TOWING
11:25:12	AXB1676	TOWER	WE ARE COORDINATING WITH COMPANY SIR
11:25:14	TOWER	AXB1676	ROGER
11:25:31	IGO7247	TOWER	TURNING RIGHT DIRECT TANGO TANGO PAPA IGO7247
11:25:52	AXB1676	TOWER	GROUND CAN WER DISEMBARK PASSENGERS WITH GROUND PERMISSION
11:25:59	TOWER	AXB1676	YOU HAVE TO TOW TO BAY NUMBER FOUR
11:26:00	AXB1676	TOWER	COPIED
11:26:25	TOWER	IGO7205	RUNWAY ZERO EIGHT CLEARED TO LAND
11:26:28	IGO7205	TOWER	CLEARED TO LAND RUNWAY ZERO EIGHT
11:46:55	AXB1676	TOWER	REQUEST TO TOW BAY NUMBER ONE SIR
11:47:02	AXB1676	GROUND	
11:47:03	TOWER	AXB1676	
11:47:05	AXB1676	TOWER	YES SIR VIJAYAWADA AXB 1676 REQUEST TOW TO THE WE ARE GOING TO BAY NUMBER ONE
11:47:11	TOWER	AXB1676	STANDBY MAM WE WILL ADVICE
11:47:13	AXB1676	TOWER	STANDING BY
11:48:19	AXB1676	TOWER	APPRON HAS GIVEN US BAY NUMBER EIGHT
11:49:01	AXB1676	TOWER	APPRON HAS GIVEN US BAY NUMBER EIGHT CAN WE PROCEED TO BAY NUMBER EIGHT
11:49:10	TOWER	AXB1676	STANDBY TO TOW AIRCRAFT WILL ADVICE YOU
11:49:15	AXB1676	TOWER	COPIED AXB1676
11:49:22	TOWER	AXB1676	BAY NUMBER EIGHT ONLY WE HAVE TO TAKE FEW PICS MADAM FEW PICS. STANDBY OUR INCHARGES ARE PROCEEDING TO THE AIRCRAFT WILL ADVICE YOU WHEN TO TOW

1.10 Aerodrome Information

The Vijayawada Airport is located in Andhra Pradesh, India. The ICAO Location Indicator Code is VOBZ and its IATA Code is VGA. This airport is operated and managed by Airports Authority of India. The airport has single runway.

Airport Co-ordinates: - Lat: 16°31’44” N
Long: 80°47’45” E.

Runway orientation and dimensions at Vijayawada Airport are:

RWY	TORA (M)	TODA (M)	ASDA (M)	LDA (M)	Remarks
08	2286	2286	2286	2108	THR DISPLACED BY 178 M
26	2286	2286	2286	2286	-----

Taxiway A is installed with edge lights only. However, it is having edge and center line markings.

1.11 Flight Recorders

Data from CVR and DRDR were downloaded and analyzed after the accident.

1.11.1 DFDR

DFDR analysis revealed that

The aircraft had followed correct decent profile and landed safely at Vijayawada Airport. After landing aircraft back tracked and vacated Runway via Taxiway A and further turned right. Aircraft was maintaining 10 kts of taxing speed.

1.11.2 CVR

The CVR readout was analyzed and following are the salient observations.

a) Landing and taxing checks were done correctly.
b) PM was communicating with ATC at the time of taxing in apron area.
c) Crew were discussing their schedule while taxing to parking bay and were showing concern about the duration of flight and their fatigue level.
d) PF had confusion over the correct taxi track path. PF checked from PM about the correct taxiway (It appeared that PM was confused).
e) While taxing, a THUD sound was heard.
f) PF informed ATC that "*TOWER AIX….. We are on the wrong taxiway. I think we have hit one of the taxi light. We want to hold the present position*."
g) ATC informed PF to hold position.
h) Ground staff instructed PF to pull the CBs of recorders.
i) Engines were shut down at apron and passenger were disembarked.

1.12 Wreckage & Impact Information

After landing on Runway 08 at Vijayawada airport, aircraft back tracked and exited via Taxiway "A", as instructed by ATC.

Aircraft was assigned Parking bay no 4, for which aircraft has to take a right turn from taxiway A. Soon after entering the taxiway 'A', aircraft took a right turn (as shown in red in the figure below) instead of going straight (as shown in green in the figure below) .

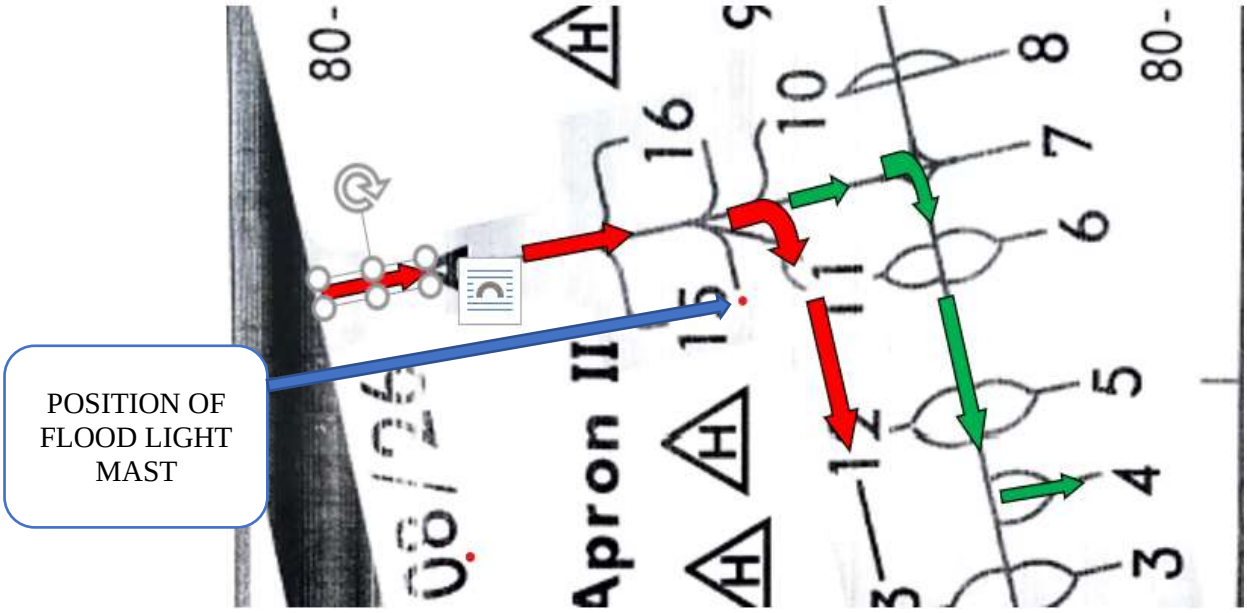

Figure: Desired and Path Followed by Aircraft.

Note:

(a) Red arrows indicates the original path followed by the aircraft.

(b) Green arrows indicates taxiway needed to be followed for assigned parking stand 4.

While turning, aircraft followed taxiway edge markings instead of centerline markings. Hence, the major portion of aircraft RH wing had protruded outside of the Apron movement area. Subsequently, the RH wing leading edge of the aircraft hit one of the flood light mast standing beside the Apron edge. Due to the impact leading edge slat No. 7 & 8 of the aircraft got substantially damaged, whereas the flood light mast bent down and fell on ground.

Figure: Damaged Flood Light Mast

1.13 Medical and Pathological Information

Prior to operating the flight, both cockpit and cabin crew had undergone Pre-flight BA test at Tiruchirappalli Airport and were found negative. After accident, Post-flight BA test were carried out at the Vijayawada Airport and were found negative.

1.14 Fire

There was no pre or post impact fire.

1.15 Survival Aspects

The accident was survivable.

1.16 Test and Research

Nil

1.17 Organizational and Management Information

Air India Express Ltd

The aircraft was operated by a scheduled operator holding AOP No. S-14 in Passenger and Cargo Category with validity till 21.04.2023. The airline commenced its operations in 2005. The headquarter of the operator is situated in Kochi. The operator currently has a fleet of 25 Boeing 737-800 aircraft.

The maintenance of the aircraft is being carried out by M/s Air India Engineering Services Ltd. (AIESL), a DGCA CAR 145 approved MRO. Operator has in house training facility for the pilots, cabin crew, airport services and Engineering.

Airports Authority of India

Airports Authority of India (AAI) is a statutory body working under the Ministry of Civil Aviation, Government of India. It provides Communication Navigation Surveillance / Air Traffic Management (CNS/ATM) services over Indian airspace and adjoining oceanic areas.

1.18 Additional Information

1.18.1 Apron Layout

Airports authority of India has published an Apron layout which shows the taxiway routing within the parking bays as A-11-12-13-14-B. Although there is no such taxiway. This gives a wrong information about the apron Layout.

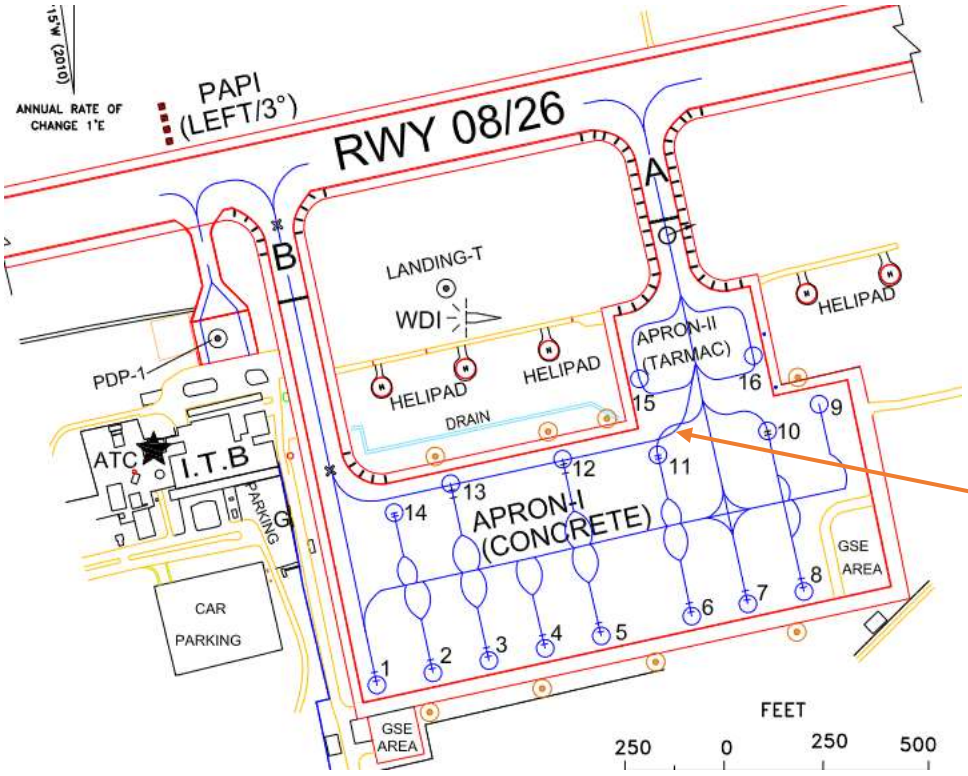

Figure: Shows wrong Taxiway marking

Vijayawada Airport is an International Airport. Crew operating here follow the aeronautical charts published by AAI. The layout on aeronautical chart of AAI found not updated during course of investigation. Non updation may create confusion in the mind of crew operating in and out of apron.

1.18.2 Taxiway and Apron Marking

(i) As per ICAO DOC 9157, the parking stand markings and dimensions states:

a. Character/Number of the marking to be yellow and boarder line with black.

b. Length of the character/Number varies from 0.5m to 1.0m.

c. Boarder line of the character/Number varies from 0.75 m to 1.50m.

d. Width of the character/Number varies according character.

It was found during investigation that the markings at the Apron were not as per laid down the standards.

Figure: Existing apron marking at Vijayawada Airport (as on date of accident)

(ii) As per ICAO DOC 9157, erasing of marking on flexible pavement:

The erasing of markings on rigid pavement has to be in matching colour with pavement i.e. Grey. During investigation it was found that the erased portion of taxiway was blur and were not as per laid down standards.

Figure: Existing marking of erased portion at Vijayawada Airport

1.18.3 Apron/Taxiway Lighting

Apron/Taxiway Edge lights are recommended on paved surface as per ICAO DOC 9157. Vijayawada Airport has installed Apron/Taxiway edge lights however, during course of investigation it was noticed that

some lights at few places were missing. This may create ambiguity/confusion in the mind of operational staff working at Aerodrome. Further, it was observed that edge lights were not installed uniformly.

After exiting from taxiway 'A' to the right in between a few lights were found to be broken. Further, number 47 and 48 edge lights were not available but all the other lights are available before and after it. In absence of edge lights, it looks like to be an uninterrupted taxiway. The point in question is about accident site where apron edge lights were missing.

Figure: Missing Edge lights in point of accident

1.18.4 Contingency Plan

Contingency plan is formulated at every airport to deal with any unforeseen circumstances. Contingency planning develops a set of detailed plan that will cover the requirements identified by stakeholders during the consultation process so as to include in the plan.

As per ATC at Vijayawada Airport, there is no contingency plan available for disembarkation of passenger in emergency. It took longer time in evacuation of passenger due to non-availability of evacuation plan.

1.18.5 Maintenance work of Marking at Airport

A periodic maintenance work at Vijayawada Airport is been carried out as per the local circular dated 03/09/2018. The circular states:

SL NO	AREA	DURATION
1	Center Line	Once in 3 months or as and when required
2	Threshold	Once in 3 months
3	Touch Down	Once in 3 months
4	Edge Marking	Once in 2 years
5	Painting of Apron Taxiway Guidelines and Bay Marking	Once in 3 months or as and when required
6	Apron Edge Marking	Once in a year

As per maintenance records provided by ATC Vijayawada Airport, last periodic maintenance of Taxiway marking and Bay number marking was done on 21/10/2020 and last Apron guideline marking was done on 12/11/2020. As per the circular Taxiway Marking and Bay number marking was scheduled on or before 20/1/2021, which was pending at the time of accident. Further, Apron Guideline markings was scheduled on or before 11/02/2021 which was also pending at the time of accident.

During investigation the team noticed that the markings at apron faded and confusing.

1.18.6 Surveillance of ATC on Apron Area

On the day of accident at Vijayawada airport, approach control, tower control and ground control, all channels were been managed by a single controller due to low density of traffic. ATC tower is located on the left of

side of apron and towards Runway 08 threshold. This restricts controller to monitor both arrivals on runway 08 and aircraft movement on Apron simultaneously . Controller cannot monitor complete apron area due to blind zone viewed from ATC tower.

A CCTV camera is installed for monitoring vehicular movements on a road running along the taxiway B. The feed of the camera is available inside the tower. The aircraft movement on the taxiway B is also being monitored by this CCTV. However, there is no CCTV coverage available for taxiway A.

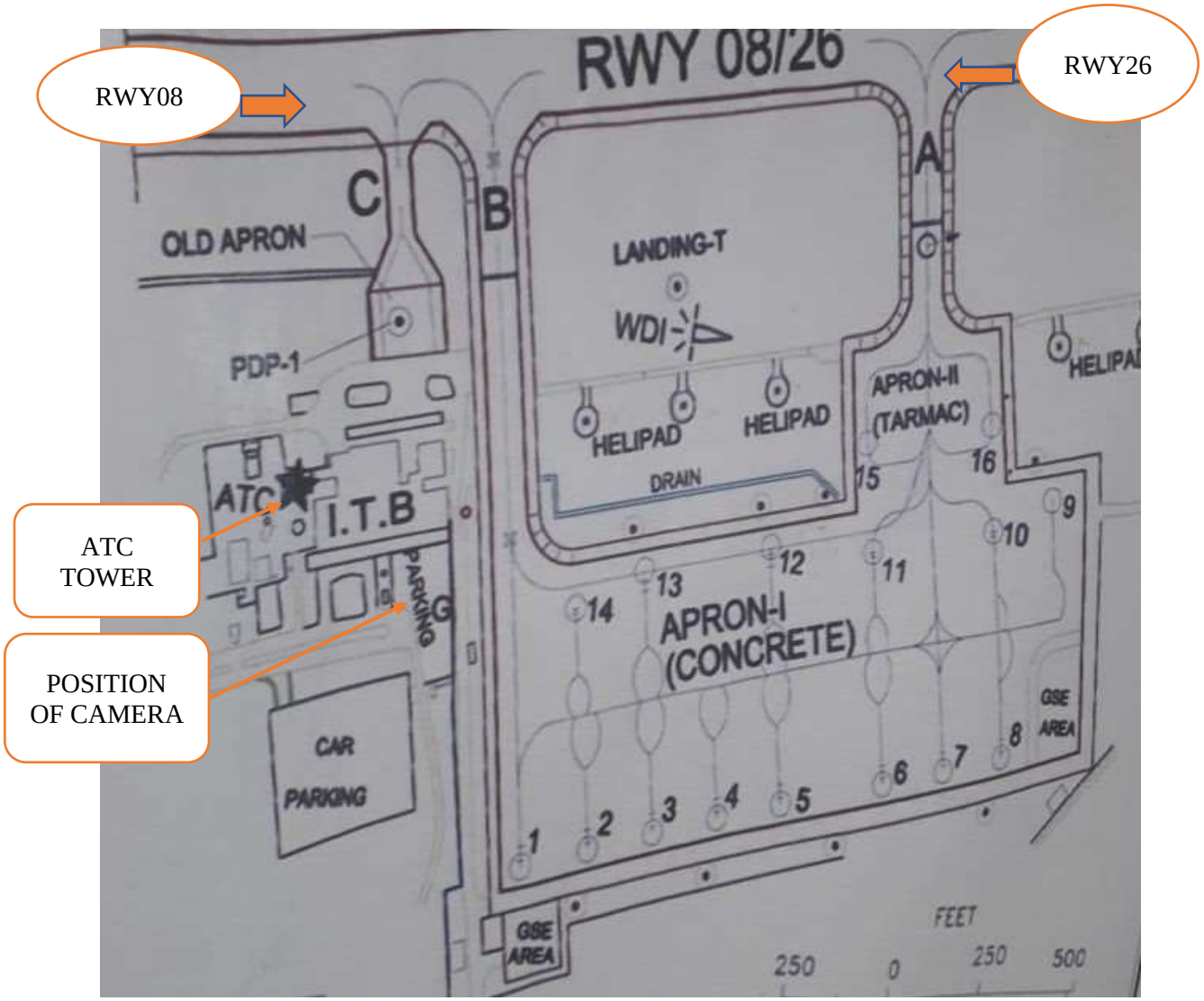

FIGURE: THE POSITIONS OF ATC TOWER, CAMERA AND RUNWAY OREINTATIONS

If any aircraft is on final Rwy 08 and controller is monitoring landing of the arriving aircraft, then there is a high probability of losing the surveillance of movement area on apron.

1.18.7 Aerodrome Surveillance Inspection by Regulator

DGCA conducts Annual Aerodrome Inspection on every airport. Last inspection was conducted at Vijayawada Airport 18/11/2020 and 19/11/2020 (prior to accident).

During course of investigation, it was observed that similar nature of findings, related to apron marking have been observed in last three annual surveillances done by DGCA. The findings were found to be closed by the DGCA for year 2018 and 2019.

Following were observed while scrutinizing last three years surveillance report on markings:

SL.NO	YEAR	FINDING	LEVEL	STATUS
1	2018	Apron Marking were found to be non-standard at several places in the Apron	II	Closed
2	2019	Aircraft parking stands does not provided with safety line, that to be provided on all aircraft stands as per CAR. Old aircraft stand marking in apron to be removed on priority to avoid confusion to pilot.	II II	Closed Closed
3	2020	Existing mandatory Runway holding/ Taxiway/ Runway vacation sign boards are non-	II	Open (at the time of Accident)

		standard (i.e. incorrect front size) & not illuminating properly. The stop line ground marking is not provided at vehicular lane which is crossing the aircraft stand taxi lane. Aircraft stop line marking provided to parking stands were not as per CAR	II II	Open (at the time of Accident) Open (at the time of Accident)

During the investigation, it was observed that non-standard marking have been done at many place on taxiway and apron at Vijayawada Airport. As per annual maintenance plan marking at the apron is to be done at every 3 months or as and when required.

1.19 **Useful or Effective Investigation Techniques**

Nil

2. ANALYSIS

2.1 General

On 20/02/2021, AXB1676 (Type- B 737-800 , Registration- VTGHE) of M/s Air India Express Ltd, was scheduled to operate its flight from Tiruchirappalli-Doha-Vijayawada. It met with an accident while taxing to parking bay at Vijayawada Airport.

For sector Tiruchirappalli-Doha, PIC was Pilot monitoring and Co-Pilot was Pilot flying. However, for Doha-Vijayawada sector PIC was PF and Co-pilot was PM. Flight was uneventful till landing at Vijayawada. During flight all the checks were found to be done correctly as per the check list.

At Airport, markings are done as per International Standards. Yellow color center line markings (yellow covered with black strip on either side) are used at apron to guide the crew of the aircraft. It helps the pilot in maneuvering the aircraft like, how to take turn, were to stop etc. An arrow is also marked in yellow color to indicate the direction of movement.

FIGURE (A) SHOWS MARKING AT APRON

(B) MARKING AT TAXIWAY A

Shoulder edge markings are in the form of yellow strips (black line covered with yellow on either side), exact reverse of taxiway markings.

FIGURE: SHOWING SHOULDER EDGE MARKING AT VIJAYAWADA AIRPORT

As per ICAO DOC 9157 (Aerodrome Design Manual), if any portion of marking needs to be erased on tarmac, it shall be completely erased by applying paint of color matching with the tarmac or grey color, so that it is not visible. At Vijayawada Airport, Taxiway marking were found faded and were not as per standards laid down in DOC 9157. At few places, taxiway marking were erased permanently but they were not in the color matching the tarmac. They were in white color paint. However, the markings erased were visible. It might create doubt in mind of the Crew.

FIGURE: SHOWING PERMANENT REMOVED MARKINGS AT APRON

FIGURE : INAPPROPRIATE MARKING AT SHOULDER

Periodic maintenance is scheduled from time to time as per the Local circular dated 03/09/2018. As per circular every 3 months marking is to be repeated. But it was pending at the time of Accident.

The last DGCA periodic annual surveillance at Vijayawada Airport was carried out on 18/11/2020 and 19/11/2020 as per CAR Section 4 Series B Part I. During the annual surveillance, DGCA had raised observation pertaining to markings and lightings at the Airport. Action taken report was submitted to DGCA on 06/01/2021 for which there was no correspondence/ reply with DGCA till the time of Accident. Prior to it in 2018 and 2019 similar findings were observed in respect of markings at Apron. These findings were closed during compliance report submitted to DGCA by AAI. However, during investigation non-standard markings were present.

After landing at Vijayawada airport, ATC instructed crew as "*LANDED ONE NINE BACKTRACK RUNWAY ZERO EIGHT VACATE VIA ALPHA BAY NUMBER FOUR*". Flight crew read back correctly and took exit from Rwy 08 via Taxiway A, at this time PM was busy in doing check as per check list and communicating with ATC. ATC was seeking details of persons on board as per circular issued to them by Regional Headquarters, AAI . This is no such practice in the country.

After giving full taxi clearance to accidented aircraft, Controller became busy with the other traffic. At that time one aircraft was for departure and one was on arrival, RWY 08. The direction of arriving aircraft was in the opposite direction to apron. Thus, movement area at apron was out of site for ATC. Though, a camera is installed near to taxiway B but it is a moving one. Therefore, it is quite difficult for a Controller to have continuous surveillance on Apron while handling arrival at runway 08.

While turning right PF was not sure about the correct turn. PF was confused whether it is first turn or second turn to the right for Bay No# 4. PF confirmed with PM about the same. But, PM was also confused at this time. Since PM was performing head down duty it took some time to analyze the situation and correct taxiway.

In-spite being confused with the correct taxi routes, instead of stopping the aircraft for confirming the taxiway either from PM or ATC, PF continued the aircraft roll at 9-10 knot speed. PF aligned itself with edge line instead of center line marking.

Aircraft continued taxi till the aircraft hit the flood light mast installed at edge of Apron, and crew heard a THUD sound. Immediately, at 11:22:52 UTC, crew gave a call to ATC controller. At that time the ATC Controller was busy in giving take off clearance to one of the departing aircraft on Runway 08. At 11:23:20 UTC, Tower replied back to flight crew, to which PF said "*WE ARE ON WRONG TAXIWAY I THINK WE HAVE HIT THE ONE OF THE TAXILIGHTS WE WANT TO HOLD THE PRESENT POSITION*".

FIGURE: SCREEN SHOT OF CCTV CAMERA INSTALLED NEAR TAXIWAY B

Subsequently, Crew shut down the engines at the accident site. Fire staff of Aerodrome and ground staff of Air India Express rushed to the accident site and later confirmed that they could not observe any oil spillage. Later, ground staff informed flight crew that the leading edge Slat No# 7 & 8 were damaged and they had hit one of the flood light mast. Ground staff also asked crew to pull the CVR/DFDR CB's. Flight crew followed instructions of ground staff.

At 11:25:52 UTC, flight crew asked for permission do disembark the passengers by controller as "*GROUND CAN WE DISEMARK PASSENGERS WITH GROUD PERMISSION*". The permission was not granted by ATC instead they were informed as "*YOU HAVE TO TOW TO BAY NUMBER FOUR*". Dis-embarkment of passengers were done at the accident site after 45 min. Aircraft RH wing leading edge was damaged due to impact of flood light mast (electric

pole). At that time, RH wing tank was containing approximately 3600 liters of highly inflammable fuel, which could have turn into disaster and evacuation of passengers shall be the utmost priority. Since there was no plan for evacuation of passenger available at Vijayawada airport, it took almost 45 min to evacuate them. After the passengers were off loaded, the aircraft was towed to the parking stand number 8.

Flight crew had undergone Post-flight BA test at Vijayawada Airport and it was found satisfactory.

Post-accident, a damage assessment was carried out by structural Aircraft Maintenance Engineer (AME) along with B1 and B2 AMEs. Damage was found on leading edge of right wing slat no# 7 & 8.

2.2 Aerodrome

Vijayawada Airport is an International airport. The markings done on taxiway and at apron were not meeting the standard laid down in DOC 9157.

Alphabets and Digits are not as per standard sizes. Marking which are not in use were either not erased properly or were blur. It has been noted in the past that ambiguity or confusion for the markings were raised by the pilots to ATC.

FIGURES: NON STANDARD MARKING AT AIRPORT (at the time of accident)

Few taxiway lights were found broken/missing intermittently. Irregular lights on taxiway shoulder create confusion in the mind of Pilot flying. As it seems to be a clear way for maneuvering.

FIGURE: MISSING TAXIWAT SHOULDER LIGHTS (at the time of accident)

These ambiguities were also pointed as findings in the annual surveillance inspection conducted by regulator. But during investigation it was found that the maintenance work at airport was pending.

As per ATC, the airport doesn't have plan to disembark the passenger for incident/accident flights. Due to which dis-embarkment of passenger was delayed.

Aerodrome layout published by AAI was also not updated. It is showing a taxiway connecting stands 11-12-13-14. However, at the time of accident this taxiway did not existed but, the same was not updated in the Aeronautical chart.

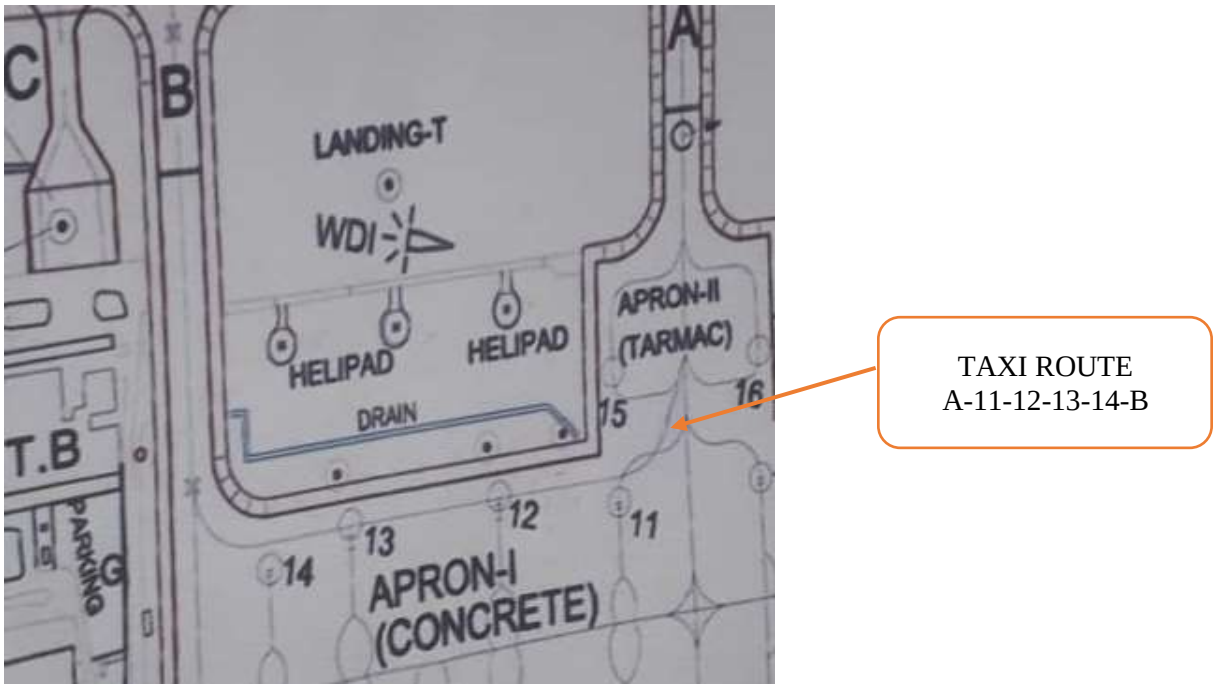

FIGURE: SHOWING PUBLISHED TAXI ROUTING WHICH IS NON OPERATIVE

2.3 Flight operation and Human Factor

Pilot flying and pilot monitoring both had operated at Vijayawada Airport before the day of accident.

Crew were discussing about the schedule of the flight while taxing to parking bay and showed their concern about the duration of flight and there fatigue level. PF was confused with the centerline marking and edge marking as both are combination of Yellow and Black strips. Although taxi routing was correctly readback by flight crew . PF took the first right and aligned the aircraft with taxiway edge marking instead of center line.

PF inquired with PM, who was supposed to look outside for clearance but at that time PM was busy with some head down duties and was also communicating with ATC. ATC was seeking number of passengers on board. PM could not access its priority of communication and surveillance.PM was also confused with the taxi route. As mind of PM was occupied by another duty and it took time to understand the current situation. Since, aircraft was moving, PM did

not get time to response to PF about the correct taxiway. Before both could conclude, aircraft right wing had hit the flood light mast.

They thought that they have hit a edge light but later ground staff confirmed that slat 7&8 leading edge of right wings are damaged and they have hit a flood light mast. They were asked to pull the CB's of CVR and DFDR to which they complied. Post-accident, they undergone BA test and it was found satisfactory.

2.4 Annual Surveillance Plan

Annual surveillance is being conducted every year by regulator as per CAR Section 4, Series B, Part I and ICAO guidance. Some findings raised by them are of Level I and some of them are of Level II nature. As per DGCA, level-I findings are to be addressed within seven days of issue. Whereas, level-II findings are to be addressed within thirty days of the issue subject to location of airport.

During investigation, it has been observed/noticed that findings of surveillance were mainly pertained to markings/lighting at apron. As per compliance report all observations were found to be closed by regulator. However, it was found during investigation that same observations on markings/lights at apron were still existing. DGCA didn't take cognizance of seriousness of similar nature of findings appearing in consecutive 3 years and every time level of finding given was level-II.

Although Vijayawada Airport had maintenance planning schedule, but few works pertaining to markings were either pending or carried out was not up to the standard.

2.5 ATC operation

Position of ATC tower at Vijayawada Airport is towards left of apron and near to Runway 08 threshold. Hence, by the virtue of its sitting position, it is difficult for a Controller to monitor both arrivals at runway 08 and aircraft movements at Apron simultaneous. ATC lacked full surveillance. Aerodrome

operator has installed a camera for surveillance of vehicular road near to Taxiway B but no such provision is there for Taxiway A.

At Vijayawada airport, Approach, tower and ground control, all three channels are being managed by a single person due to less number of traffic. At the time of accident there were total 3 aircraft which were in contact of controller. An aircraft was taxing out for departure, another aircraft was on finals for runway 08 and accidented flight AXB1676 was taxing in for parking bay 04.

After giving taxi instruction up to parking bay to flight AXB1676, Controller became busy in handling other (arrival/departure) traffics. As there was no other means of surveillance like camera etc available to the controller except visually checking the aircraft position or by asking on VHF. Therefore the controller had lost active visual surveillance over AXB1676. However, when aircraft was taxiing, ATC Controller had sought 3-4 times regarding passengers on board without visual contact.

As per the order issued by AAI southern region, Controller is required to take the number of passengers on board and crew on board separately. Regional headquarters requires this data in the format issued by them. Every day it is submitted by Southern Airports to its Regional headquarters. This practice is not done universally. This is an extra burden on controllers. Which effect the working in peak hours. Because of this, ATC was asking for passenger on board and number of crew separately from AXB1676 hence, keeping pilot monitoring busy. ATC gave multiple calls to flight crew for the same. Hence, PM did not monitored the situation outside.

2.6 Dis-embarkment of Passenger

Post-accident, there was a delay in dis-embarkment of passenger. The delay was due to lack of written procedure with AAI for evacuating the stranded passengers. After accident, ATC Controller had sought permission from the higher/concern authority which resulted in delay of dis-embarkation. Passengers of the accidented flight had to wait almost 45 min inside the aircraft in-spite of

hitting the electric pole by its wing. Although, no fuel leakage was observed by ground staff, but there may be chances that they might be not aware of damages inside the aircraft wing (fuel tank) and could had laid to fire disaster.

After off loading the passengers, the aircraft was towed to parking stand.

3.0 CONCLUSION

3.1 Findings

i. Aircraft was airworthy and CVR/DFDR installed were in operational conditions.
ii. All nav-aids, VHF communication were working normal.
iii. Flight crew were current on type and having valid medical.
iv. Concern controller was having valid ratings and valid medical.
v. Same crew had perform last flight i.e. Tiruchirappalli – Doha. For this sector Co-pilot was PF and PIC was PM.
vi. For sector Doha – Vijayawada, PIC was pilot flying and Co-pilot was PM.
vii. Approach, Tower and ground controls are combined at Vijayawada Airport.
viii. Runway in use at Vijayawada Airport was RWY 08.
ix. At the time of accident there were three aircraft in contact with ATC. One was on finals RWY 08, one departure was taxing out for RWY 08 and accidented flight was taxing in for parking stand 4.
x. Flight was uneventful till landing.
xi. All the check were performed as per the check list.
xii. After landing ATC asked to back track and exit via taxiway A and proceed to bay 4.
xiii. Layout of aerodrome is not updated on published aeronautical chart.
xiv. Airport markings were not as per standards laid down in DOC 9157.
xv. Some places the marking were blur and at some places marking was not properly erased.
xvi. Some shoulder lights were missing.

xvii. PF was confused with the marking between center line and edge line, as both are a combination of yellow and black strips.

xviii. PF took immediate right turn after exiting taxiway A.

xix. Immediately after taking the turn PF realized that aircraft may have entered into wrong taxiway.

xx. PF confirmed with PM about the same.

xxi. PM was on heads down duty and was communicating with ATC, was also confused over the correct taxiway.

xxii. ATC kept PM engaged by repeatedly asking for persons on board. As per AAI Regional Headquarters instruction.

xxiii. In-spite of confusion PF kept on moving aircraft at a speed of 8-10 Kts.

xxiv. A 'THUD' sound came when an aircraft hit the electric mast.

xxv. ATC was concentrated towards other traffic and was not monitoring the accidented flight.

xxvi. Current location of tower restricts apron movement and arrival on RWY 08 simultaneously.

xxvii. ATC lacked surveillance in apron area.

xxviii. There is no camera installed at apron whose display came be monitored from tower for any movement.

xxix. Ground staff confirmed PF that they have hit a flood light mast and RH wing leading edge slat no# 7 & 8 has damaged.

xxx. No fuel leak was observed post-accident.

xxxi. Ground staff asked PF to pull out the CB switches of CVR/DFDR.

xxxii. The aircraft was switched off at the site of accident.

xxxiii. PIC asked to disembark the passenger but ATC asked to stand by. It took around 45 min to get the confirmation from ATC.

xxxiv. There is no laid down procedure in contingency plan of airport on disembarkation of passengers from the accidented/incidental aircraft.

xxxv. Post-accident aircraft was towed to stands.

xxxvi. Flight crew had undergone post-accident BA test and found satisfactory.

3.2 Probable cause

The probable cause of accident was due to crew not following correct taxi marking.

3.3 Contributory Factor

i. Aeronautical charts published by AAI were not updated.
ii. Non-standard taxiway and apron marking.
iii. As PM was busy in head down duty, the outside situation was not being monitored while taxing.
iv. Lack of surveillance by ATC.
v. No action taken by aerodrome operator on repetitive observation by regulator on aerodrome marking.

4.0 SAFETY RECOMMENDATIONS

i. Operator may impart suitable training to the flight crew of AXB1676 giving emphasis on duties and responsibility as a Pilot flying and Pilot monitoring and situational awareness.
ii. AAI may sensitize its controller about positive visual contact with the aircraft as far as possible.
iii. AAI may install a camera to its hotspots and blind area in order to have better surveillance.
iv. AAI may revisit its circular for seeking the details of passenger on board by arriving aircraft through ATC.
v. AAI may regularly update aeronautical charts for all airports.
vi. DGCA may ensure that the airport has guidelines to evacuate the passenger in case of occurrences.

vii. DGCA may revisit its surveillance procedures and techniques in order to put more stress on areas of repetitive findings at the Airports.

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