



सत्यमेव जयते

**AIRCRAFT ACCIDENT INVESTIGATION BUREAU**

**FINAL INVESTIGATION REPORT  
ON SERIOUS INCIDENT INVOLVING  
M/S AIR INDIA'S BOEING 777-300 ER AIRCRAFT VT-ALJ  
AT MUMBAI ON 22.02.2016**

**Jasbir Singh Larhga  
Deputy Director, AAIB  
Member COI, VT-ALJ**

**Amit Gupta  
Director, DGCA  
Chairman COI, VT-ALJ**

## *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 2012, the sole objective of the investigation of an accident shall be the prevention of accidents and incidents and not apportion blame or liability.*

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

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**FINAL INVESTIGATION REPORT ON SERIOUS INCIDENT INVOLVING M/S AIR  
INDIA'S BOEING 777-300 ER AIRCRAFT VT-AJL AT MUMBAI ON 22.02.2016**

1	Aircraft	Type	Boeing B 777-300 ER
		Nationality	Indian
		Registration	VT-AJL
2	Owner		M/s Golden State Aircraft LLC
3	Operator		Air India Limited
4	Pilot – in –Command		ALTP Holder
	Extent of injuries		NIL
5	Co Pilot		ALTP Holder
	Extent of injuries		NIL
6	Date & Time of Incident		22 <sup>nd</sup> Feb 2016, 1946 UTC
7	Place of Incident		Chhatrapati Shivaji International Airport (CSIA), Mumbai
8	Last point of Departure		Ahmedabad Airport, Gujarat
9	Intended landing place		Chhatrapati Shivaji International Airport (CSIA), Mumbai
10	No. of Passengers on board		319
	Extent of injuries		NIL
11	Crew on Board		02+ 10
	Extent of injuries		NIL
12	Type of Operation		Scheduled Passenger Flight
13	Phase of Operation		During Taxi-in
14	Type of Serious Incident		Wing Hit with High Mast Lighting Electric Pole during taxiing.
15	Co-ordinates of Occurrence Site		19° 05 ' 35.45" N, 72° 52' 40.95 " E

(ALL TIMINGS IN THE REPORT ARE IN UTC)

## SUMMARY

On 22.02.2016, Air India's B777-300 ER aircraft VT-ALJ while operating a scheduled flight AI-191 from Ahmedabad to Mumbai was involved in a serious incident wherein the right wing of the aircraft hit a high mast lighting pole while taxiing at Mumbai Airport. The aircraft was under the command of an ATPL holder pilot and a co-pilot with ALTP License on type. There were 319 passengers and 10 cabin crew on board the aircraft. There was no injury reported to any person on board or on ground.

Flight AI 191 operated by VT-ALJ took off from Ahmedabad at 1856 UTC and landed on "Runway 27 Mumbai" at 1940 UTC. VT-ALJ is a Code E category aircraft with a wing span of 64.8 m. After landing at Mumbai, the aircraft was given taxi clearance for parking bay K5 to taxi via "N - Cross RWY 14 - N1 - Hold short of M6 - M - M4 - Y1 - Y3 - K5" in South East Pier. The clearance was incorrect and was not as per the SOP. The centreline lighting for Code E aircraft operations was also not switched on, and neither "Follow Me" vehicle service as per the SOP was provided to VT-ALJ.

Taxiway Y1 was not suitable for Code E aircraft and while taxiing on taxiway Y1, the aircraft's RH wing hit a High Mast Lighting Pole. The crew experienced a shudder but were unaware that aircraft had hit a pole. The crew had earlier noticed a ground marking "MAX SPAN 36M" but continued to taxi irrespective of the fact that wing span of VT-ALJ was 64.8 m.

Crew were provided inadequate pre-flight briefing by the Flight Dispatch, and were not aware of the changes introduced for operations of Code E and Code C aircraft in South East Pier vide NOTAM A0056/15 and revised SOP.

During post flight inspection, crew noticed damage to the aircraft's RH wing and the same was reported to ATC. "Follow-me" vehicle also noticed that High Mast Lighting Pole had collapsed in the area between taxiway Y1 and perimeter road.

Ministry of Civil Aviation vide Order No. AV 15029/02/2016-DG dated 9<sup>th</sup> March 2016 constituted a "Committee of Inquiry" to investigate into cause of the Serious Incident under Rule 11 (1) of Aircraft (Investigation of Accidents and Incidents),

Rules 2012. The committee included Sh. Raje Bhatnagar Assistant Director, AAIB as Chairman, along with Dr. Jitendra Loura, Assistant Director, AAIB and Sh. Jasbir Singh Larhga, Assistant Director, AAIB as members.

Subsequently, Ministry of Civil Aviation amended the order vide gazette notification dated 15<sup>th</sup> July 2019 and appointed Sh. Amit Gupta, Director-AED, DGCA as Chairman in place of Sh. Raje Bhatnagar Assistant Director, AAIB and the name of Dr. Jitendra Loura was deleted.

The probable cause of Serious Incident was "In-correct Taxi clearance" and "Non- Adherence of SOP for operations in South East Pier".

#### Contributory factors

- 1) Inadequate and Improper Pre-Flight Briefing.
- 2) Non-Compliance of Ground Warning Sign "MAX SPAN 36 M".

# 1 FACTUAL INFORMATION

## 1.1 History of the Flight

Air India Flight AI191 operates Ahmedabad – Mumbai leg of Ahmedabad – Mumbai – Newark sector. Air India Flight AI144 operates Mumbai –Ahmedabad leg of Newark – Mumbai – Ahmedabad sector. The schedule time of departure of AI144to Ahmedabad is 1325 UTC. However, on 22.02.2016, there was delay of 1 hour and 37 minutes, because the incoming aircraft from Newark could not operate due to technical glitch. The aircraft assigned for Mumbai – Ahmedabad – Mumbai leg was VT-ALM, but due to snag the flight was operated by VT-ALJ which arrived from Delhi as Flight AI102.

The actual time of departure of AI144 from Mumbai was 1502 UTC and flight landed at Ahmedabad at 1620 UTC. There was ground halt of 01 hour at Ahmedabad. Ahmedabad to Mumbai leg was to be operated as Flight AI191. At Ahmedabad the aircraft pushed back at 1720 UTC. But the aircraft had to be towed back to the bay as it's Left Engine could not start. After maintenance action, left engine was started at bay and aircraft was pushed back again at 1845 UTC. The flight AI191 took off at 1856 UTC from Ahmedabad to Mumbai and was uneventful. Aircraft landed at RWY 27 at 1940 UTC. Both flights (AI191 and AI 144) were operated by the same crew. The layout of aerodrome showing track followed by aircraft is shown in Figure 1 below:-



Figure : 1



The aircraft was given taxi clearance after landing at Mumbai for parking bay "K5" and instructed to taxi via "N - Cross Rwy 14 - N1 - Hold short of M6". Thereafter, AI191 was instructed to continue taxi via "M6 - M - M4 - Y1 - Y3" to parking bay K5 in South East Pier. The layout of South East Pier and track followed by the aircraft on its way to bay K5 is shown in the Figure 2 below: -

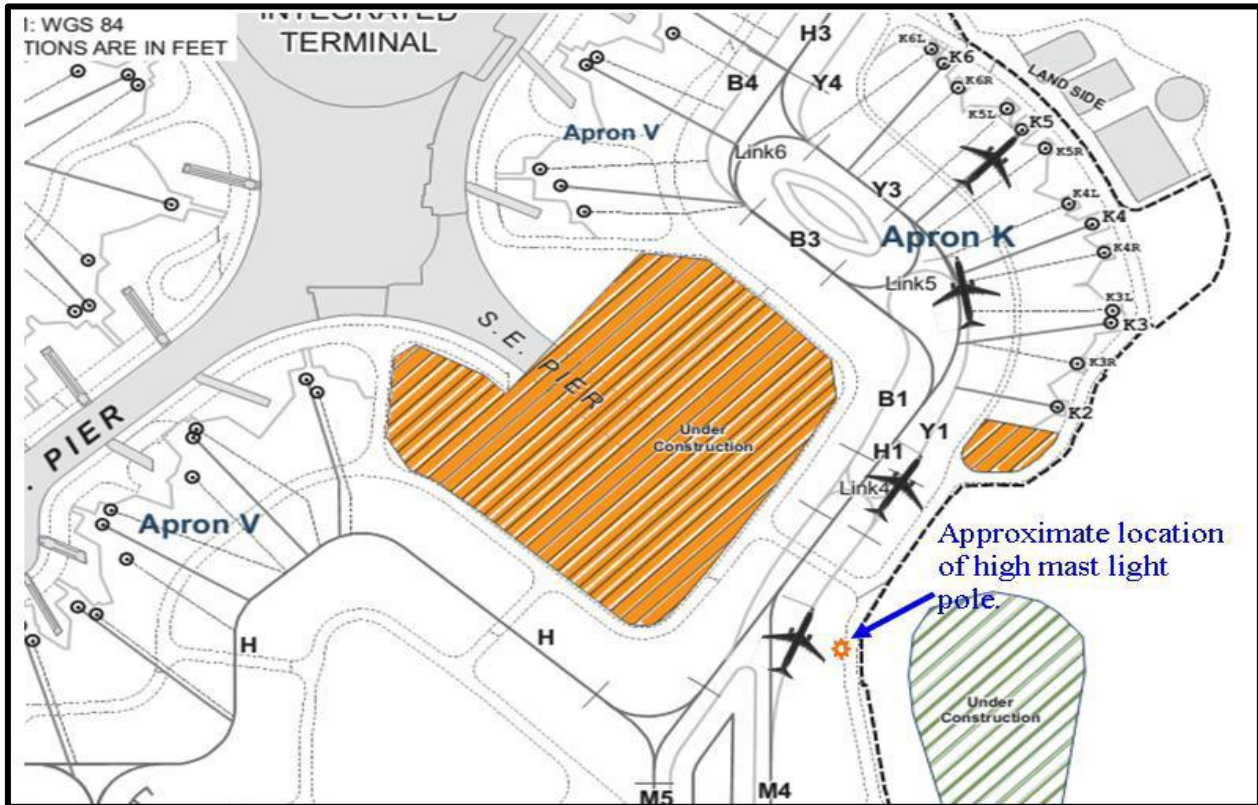


Figure : 2

The crew followed the taxi instructions and noticed a ground marking indicating "MAX SPAN 36 M" while entering taxiway Y1, but continued as per the taxi instructions. While the aircraft was taxiing on its way to taxiway Y3, the crew experienced a shudder, but did not realise that the aircraft had hit the High Mast Lighting Pole.

The aircraft was required to be provided a "Follow Me" vehicle at taxiway M4 as per the procedure followed for Code E aircraft, however, the "Follow Me" vehicle arrived and provided service only at taxiway Y3 after hearing radio communication about allotment of parking bay K5 to AI191. Crew informed ATC about nose gear shudder experienced on taxiway Y1 in-bound to taxiway Y3. The "Follow Me" jeep while returning from bay K5 also noticed that the High Mast Lighting Pole was damaged.

During post flight inspection, Crew noticed the damage on the leading edge of RH wing. The Leading edge of the RH wing had suffered damage at a distance of 29 inches from the wing tip due to impact with the High Mast Lighting Pole. The impact with the wing of the aircraft had also caused the lamp post to bend and, tear partly at the base resulting in its collapse.

### 1.2 Injuries to Persons

<b>INJURIES</b>	<b>CREW</b>	<b>PASSENGERS</b>	<b>OTHERS</b>
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR/NONE	Nil	Nil	Nil

### 1.3 Damage to Aircraft

The leading edge of the RH wing (Slat part no. 114W5110-6 and Leading Edge Bottom Panel 621AFB) suffered damaged at a distance of 29 inches from the wing tip due to impact with the High Mast Lighting Pole. The damages are shown in the Figure 3 and Figure 4 below: -



Figure : 3



Figure : 4

#### 1.4 Other Damage

The High Mast Lighting Pole was hit by the aircraft at a wing height. The resulting impact caused the lamp post to bend and tear partly at its bottom before falling down. The Lamp post fell onto area between taxiway Y1 and perimeter road.



Figure : 5



Figure : 6

## 1.5 Personnel information

### 1.5.1 Pilot – in – Command

Age	34 Yrs
Date of License Issue	07-07-2008
Valid up to	06-07-2016
Category	ALTP -- Aeroplanes
Endorsements as PIC	B777-200/300 ER
Date of Med. Exam	29-09-2015
Date of Med. Exam validity	28-09-2016
FRTOL valid up to	25-07-2017
RTR (A) Validity	Life Time
Total flying experience	4362:12 Hrs
Total Experience as PIC on type	2166:27 Hrs
Total flying experience during last 180 days	116:40 Hrs
Total flying experience during last 30 days	26:21 Hrs
Total flying experience during last 07 Days	09:15 Hrs
Total flying experience during last 24 Hours	02: 45 Hrs

The PIC had operated 25 flights to/from Mumbai between 01<sup>st</sup> September 2015 to 22<sup>nd</sup> February 2016.

### 1.5.2 Co-Pilot

Age	30 Yrs
Date of License Issue	29-11-2010
Valid up to	28-11-2016
Category	ALTP-Aeroplanes
Endorsements as PIC	N / A
Date of Med. Exam	29-09-2015
Date of Med. Exam validity	30-09-2016
FRTOL valid up to	02-01-2017
RTR (A) Validity	16-08-2016
Total flying experience	4203:07 Hrs
Total Experience as PIC on type	NIL
Last flown on type	22-02-2016
Total flying experience during last 01 Year	329:45 Hrs
Total flying experience during last 180 days	161:10 Hrs
Total flying experience during last 90 days	61:40 Hrs
Total flying experience during last 30 days	22:10 Hrs
Total flying experience during last 07 Days	08:40 Hrs
Total flying experience during last 24 Hours	02:45 Hrs
Previous Incident History	NIL

The Co-pilot had operated 17 flights to/from Mumbai between 01<sup>st</sup> September 2015 to 22<sup>nd</sup> February 2016.

As per their statements, both crew had not carried out taxiing via South East Pier earlier. None of the crew were involved in any serious incident / accident in the past. Both crew had adequate rest as per the Flight Duty Time Limitations (FDTL) requirement prior to operating the incident flight.



## 1.6 Aircraft Information

The Boeing 777-300 ER is a long-range wide-body twin-engine jet airliner developed and manufactured by Boeing Commercial Airplanes and is fitted with two (02) General Electric GE90-115B turbofan Engines having the maximum thrust of 115,000 Lbf (513 kN) each. The aircraft is having a typical seating capacity of 314 to 396 passengers, with a range of Range is 7,705 nm (14,270 km) and Cruise speed 0.84 Mach (892 km/h).

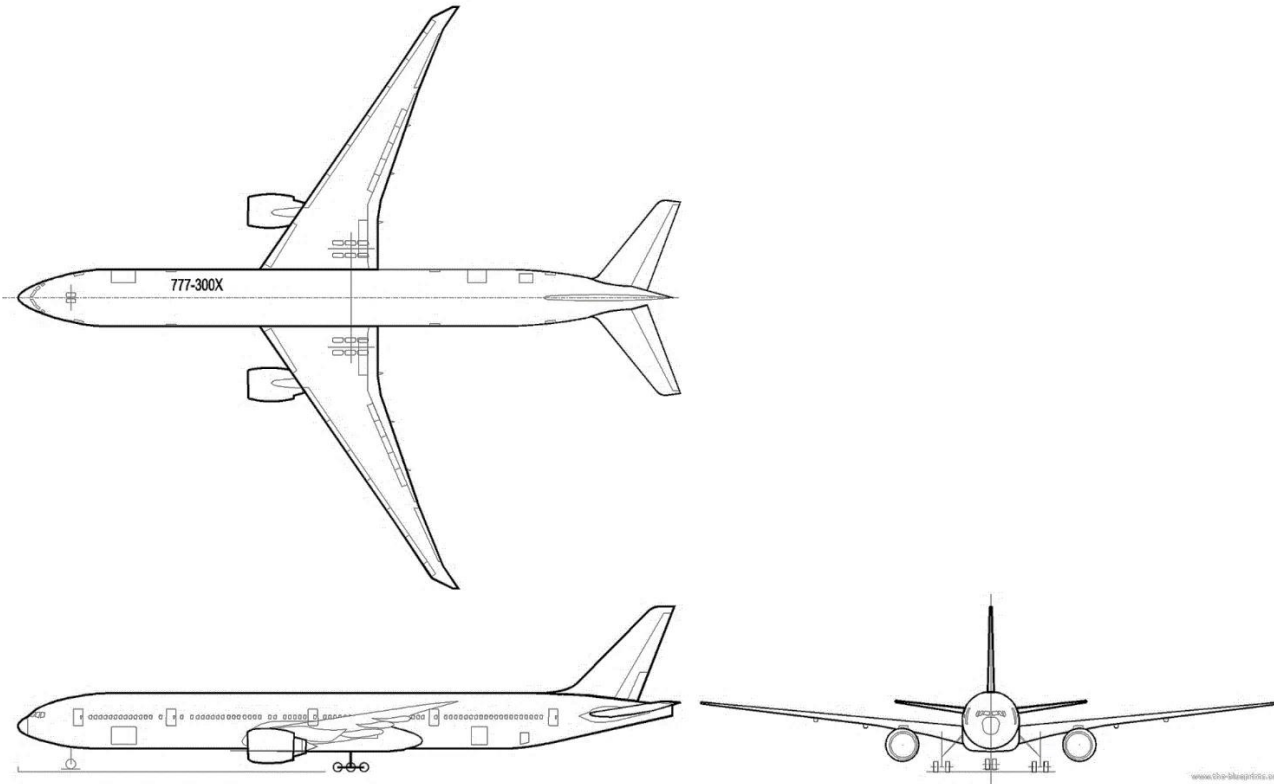


Figure : 7

The maximum operating altitude is 43,100 feet (13,135 m). Aircraft length is 242.33 ft (73.93 m), wingspan is 212.6 ft (64.8 meters), height 60.92 ft (18.58 m), Wheel track is 36.00 ft (10.97 m), Wheel base 36.00 ft (10.97 m). The aircraft was certified in Transport Category FAR Part 25 and Part 36 for day & Night Operations under VFR & IFR.

The aircraft VT-ALJ was delivered to Air India on 10 Oct 2007. It is configured for 04 First Class Seat, 35 Business class and 303 Economy class passengers' seat. At the time of incident, there were 319 passengers on board the aircraft.

### 1.6.1 Aircraft Technical Information

Aircraft Type	B 777-300 ER
Registration Marking &S.No.	VT-ALJ, MSN : 36308
First Flight	28-09-2007
Date of Arrival in India	Oct 2007
Certificate of Registration No.	3594/2
Date of Issue	11-07-2007
Certificate of Airworthiness No.	3003
Validity of Certificate of Airworthiness	Unlimited.
C of A Category	Normal
C of A Sub Division	Passenger/ Mail/Goods
ARC Reference No.	ALJ/3003/ARC 2ND/2015/222
Date of Issue of ARC	20.10.2015
ARC was valid	24.10.2016
Aircraft Hours on 23-02-2016	32509 hrs
Flight Cycle on 23-02-2016	4705
Type of Engine	GE GE90-115B
Engine Power	115,000 lbf (513 kN)
Maximum Take-off weight	351534 Kgs
Actual Take-off weight	254754 Kgs
Maximum Landing weight	251290 Kgs
Actual Landing weight	247800 Kgs

### 1.7 Meteorological Information

As per the METAR, following meteorological conditions existed.

Time (UTC)	1930 UTC
Wind	020 <sup>0</sup> /03 knots
Visibility	3200 m
Temp	24 <sup>0</sup> C
Dew Point	11 <sup>0</sup> C
QNH	1013 hPa
QFE	1012 hPa
Clouds	Scattered at 10000 feet
Weather	Smoke
Trend	No significant Weather Change

No significant trend was reported by ATC. CVR tape transcript revealed that the weather information was also passed by the ATC to the aircraft while giving the landing clearance.

## 1.8 Aids to Navigation

Mumbai airport is equipped with VOR (Frequency 116.60 MHz), DME (Frequency 1200/1137 MHz), NDB (Frequency 396 kHz) and ASDE (Frequency 9375 MHz). PAPI & ILS Cat- II is installed on Runway 27. Runway 09 and 14 are equipped with PAPI & ILS Cat-I. SALS is installed at Runway 32.

## 1.9 Communications

The details of ATS communication facilities available at Mumbai airport is given in the table below:-

Service designation	Call sign	Frequency	Remarks
TAR	Mumbai Radar	119.3 MHZ 127.9 MHZ	SDBY Frequency -----
SEARCH AND RESCUE	-	123.1 MHZ	-----
APP	Mumbai Approach	119.3 MHZ 120.35 MHZ 127.9 MHZ	----- SDBY Frequency -----
TWR	Mumbai Tower	118.1 MHZ 122.5 MHZ	----- SDBY Frequency
ATIS	Mumbai information	126.4 MHZ	-----
ACC FEEDER	---	133.3 MHZ 133.85 MHZ	----- SDBY Frequency
EMERGENCY FREQUENCY	----	121.5 MHZ	-----
ACC / RSR (S)	Mumbai Control / Radar	120.5 MHZ 125.35 MHZ	SDBY Frequency -----
CLEARANCE DELIVERY	Mumbai Delivery	121.85 MHZ	-----
ACC / RSR (N)	Mumbai Control / Radar	120.5 MHZ 132.7 MHZ	SDBY Frequency -----
SMC	Mumbai Ground	121.75 MHZ 121.85 MHZ 121.9 MHZ	----- ----- -----

The aircraft was in contact with Mumbai SMC on frequency 121.9 Mhz while taxiing to parking bay K5. From the tape transcript, it is apparent that there was no communication problem between the Flight Crew & SMC.



Relevant portion of Tape Transcript of Surface Movement Control (SMC) Controller at Frequency 121.9 Mhz is as below.

<b>TIME (HHMMSS)</b>	<b>FROM</b>	<b>TEXT</b>
194057	AIC191	GND NAMASHKAR AIC191, IS WITH YOU TURNING RIGHT ON N
194101	SMC	AIC191 NAMASHKAR, TAXI VIA "N - CROSS RWY 14 - N1 - HOLD SHORT OF M6"
194109	AIC191	OKAY, "N - CROSS RWY 14 - N1 - HOLD SHORT TO M6", AIC191
194347	SMC	AIC191 CONTINUE ON "M6 - M - M4 - Y1 - Y3 - STAND K5".
194356	AIC191	OK, "M6 - M - M4 - Y1 - Y3 - STAND K5", AIC191
194813	UNKNOWN	ADVISE AIC191 TO FOLLOW THE FOLLOW ME
195100	AIC191	GND AIC191
195102	SMC	AIC191 GO
195104	AIC191	OK THERE WAS A SHUDDER WE EXPERIENCED ON "Y1" IN BOUND TO "Y3"
195114	SMC	CAN YOU SAY AGAIN
195116	AIC191	THERE WAS A NOSE GEAR SHUDDER, WE EXPERIENCED ON "Y1" IN BOUND TO "Y3"
195121	SMC	ROGER SIR COPIED WILL INFORM THE CONCERNED
195129	UNKNOWN	MUMBAI GND IT FELT THAT THERE WAS A FALLEN OBJECT. IT'S PRETTY SURE THOUGH, BIG TRIPPLE SEVEN'S LAMP, PRETTY SURE THERE WAS SOMETHING
195137	SMC	ROGER

### **1.10 Aerodrome Information**

Chhatrapati Shivaji International Airport (CSIA) is an international airport located in Mumbai, Maharashtra. The IATA location Identifier Code is BOM and ICAO Location Indicator Code is VABB. The airport is operated by Mumbai International Airport Limited (MIAL), a Joint Venture between the Airports Authority of India (AAI) and a consortium led by GVK Industries Ltd. The elevation (AMSL) of airport is 11.9 m (39.1 ft). The airport held license No. AL/Public /005 issued by DGCA, which was valid upto 02-05-2016 on the day of incident, for both IFR and VFR traffic. The airport

reference code is 4F. The airport has two cross runways made of Asphalt. The length of Runways is as under

- **Rwy 09** -- 3188m × 60m
- **Rwy 27**-- 3448m × 60m
- **Rwy 14/32**-- 2871m × 45m

The Airport Reference Point is 19°05'30" N, 072°51'58" E. Runway has marking for Designation, THR, TDZ, Centreline, Rwy Edge and is lighted for THR, Edge, End, TDZ, and Centreline. The Airport Rescue and Fire Fighting Services available at Mumbai Airport is as per "Category 10" standard.

### 1.11 Flight Recorders

The aircraft was fitted with Solid State CVR & DFDR as per table given below. The recorders showed no signs of damage. Data from both CVR & DFDR was downloaded and analysed after the serious incident.

No	Unit	Manufacturer	Part Number	Serial Number
1	CVR	Honeywell, USA	980-6022-001	0227
2	DFDR		980-4700-042	12914

#### 1.11.1 Cockpit Voice Recorders

The CVR was downloaded with the help of RPGSE unit and decompressed into 05 Audio channels were found in CVR. The channels are

- 1 P Channel recordings of duration 30:22 minutes
- 2 P Channel recordings of duration 30:22 minutes
- 3 P Channel recordings of duration 30:22 minutes
- 4PChannel recordings containing Cockpit Area Microphone (CAM) of duration 02:00:51 minutes
- MP Channel recordings containing the audio information from all the individual crew positions (HOT) Microphone of duration 02:04:51 minutes.

The salient relevant recording of CVR is as under:-

<b>Elapsed Time as per CVR</b>	<b>UTC time as per ATC Transcript</b>	<b>Call out by</b>	<b>Call Outs</b>
01:08:41		P2	Tower <i>Namaskar</i> , AI-191.....
		ATC	AI191 <i>Namaskar</i> , RW 27, clear to land., wind calm
01:10:56	19:40:57	P2	Ground, <i>Namaskar</i> , AI191 is with you, turning right on "N"
	19:41:01	ATC	AI191, <i>Namaskar</i> , Taxi via N cross RW 14 - N1- hold short of M6
	19:41:09	P2	.....N - cross RW 14 - N1 hold short of M6, AI191
01:13:47	19:43:47	ATC	AI191, continue on "M6 - M - M4 - Y1 - Y3 - stand K5".
01:13:56	19:43:56	P2	Ok, "M6 - M - M4 - Y1 - Y3 - stand K5", AI191
		P1	M6 - M - M4, just cross check
		P1	...going to "Y1".....
		P2	.....follow these green and it will take us to the bay
		P1	Check
		P1	Thank God for the green
		P2	.....watch the right .....we have to be on
		P1	Just check right left, what is the maximum span 36 meter
		P2	Yaa but we have much more than that
01:18:39		P2	.....follow, the follow me
		P1	K5 is insight
		P2	.....Y.....I don't know what to do because .....Wheel.....over something..... (overlapping with other conversations)
01:20:59	19:51:00	P1	Ground AI191
01:21:01	19:51:02	ATC	AI 191 Go
01:21:03	19:51:04	P1	Ok. There was a shudder we experienced on "Y1" in bound to "Y3".
	19:51:14	ATC	Can you Say again
	19:51:16	P1	There was a nose gear shudder we experienced on Y1 in bound to Y3
		ATC	Roger copied
		P1	Tell ground

01:21:26		ATC	Will inform the concerned
	19:51:29	P2	Mumbai ground it feel that there was a some kind of fallen object. It's pretty sure though, big triple seven's lamp, pretty sure there was something.
	19:51:37	Ground	Roger
01:22:19		I/C	<i>Shut down checklist carried out.</i>

### 1.11.2 Digital Flight Data Recorder

Salient events and corresponding parameters as per the data available in DFDR are as below:-

UTC FDR	Events as per Transcript & FDR	MAG HDG DEG	CAS KNTS	GND SPD KNTS	N1 LH RPM	N1 RH RPM	ROLL	PITCH	WND DIR DEG	WND SPD KNTS
19:39:45	Starting of FDR data	270	154	158	55.7	55.8	0.9	1.5	113	1
19:40:13	Touch Down	270	124	131	31.9	31.7	0.4	0	93	5
19:43:47	SMC asked to continue via Y1	90	30	27	21.5	21.5	-0.1	-0.3	91	23
19:43:56	Acknowledged by A/c	90	30	28	21.5	21.5	0.0	-0.1	90	22
19:48:13	A/c advised to follow ME	24	30	9	21.5	21.4	0.2	-0.1	22	41
19:50:30	End of FDR data	43	30	2	11.8	13.5	0.0	-0.8	41	49

### 1.12 Wreckage and Impact Information

The Leading edge of the RH wing suffered damaged at a distance of 29 inches from the wing tip due to its impact with the High Mast Lighting Electric Pole. Dimension of LE Slat Damage was 24 inch X 19 inch. The damage was beyond the scope of Structural Repair Manual.

The High Mast Lighting Electric Pole lamp post was hit by the aircraft at wing height and collapsed onto area between taxiway Y1 and perimeter road.

### **1.13 Medical and Pathological Information**

Prior to operating the flight (Mumbai- Ahmedabad- Mumbai), both cockpit crew & all cabin crew had undergone pre-flight medical /breath analyser test at Mumbai and the results of the test were satisfactory.

### **1.14 Fire**

There was no pre or post impact fire. The aircraft continued to taxi after hitting the High Mast Lighting Pole and did not require any assistance to reach the allotted parking bay.

### **1.15 Survival Aspects**

The incident was survivable. The aircraft was taxiing at a Ground Speed of about 27 Knots at the time of impact. There was no injury to any passenger, crew or any personnel on ground.

### **1.16 Tests and Research**

Nil

### **1.17 Organisation and Management Information**

Air India Limited, is a Scheduled Airlines and operates a fleet of Airbus and Boeing aircraft. It is a public sector undertaking under Ministry of Civil Aviation. The airline has headquarters in New Delhi. Its primary hub is at Indira Gandhi International Airport, New Delhi, and secondary hub at Chhatrapati Shivaji International Airport, Mumbai. The airline had a DGCA Air Operator's Permit (AOP) No. S-9 in Category "Passenger and Cargo" which was valid up to 30.06.2018 on the day of incident. The Airline IATA Code is "AI", ICAO code "AIC" and call sign "Air India". The airline operates a fleet of 113 aircraft which includes 24 Airbus A319-100 aircraft, 28 Airbus A320-200 aircraft, 20 Airbus A321-200 aircraft, 05 Boeing 747-400

aircraft, 15 Boeing 777 aircraft and 21 Boeing 787. Air India is having 02 subsidiaries as Air India Express & Air India Regional which have separate permits. The Company is headed by Chairman & Managing Director assisted by a team of professionals.

### 1.17.1 Crew Advisory issued by Air India

Crew Advisory No. 23 dated 01.09.2015 was issued by Air India to all its crew regarding taxiing of aircraft in South East Pier. As per the advisory issued to the operating crew, South East Pier side facilities, markings and lighting for Code C taxiway, were in deviation from standards. Further, as per the advisory to the crew "the ground marking of Code E Taxiways has been kept as 'Yellow' and 'Green' for taxiway centerline markings and centerline lights respectively". Screenshot of the advisory is shown in the Figure 8 below: -

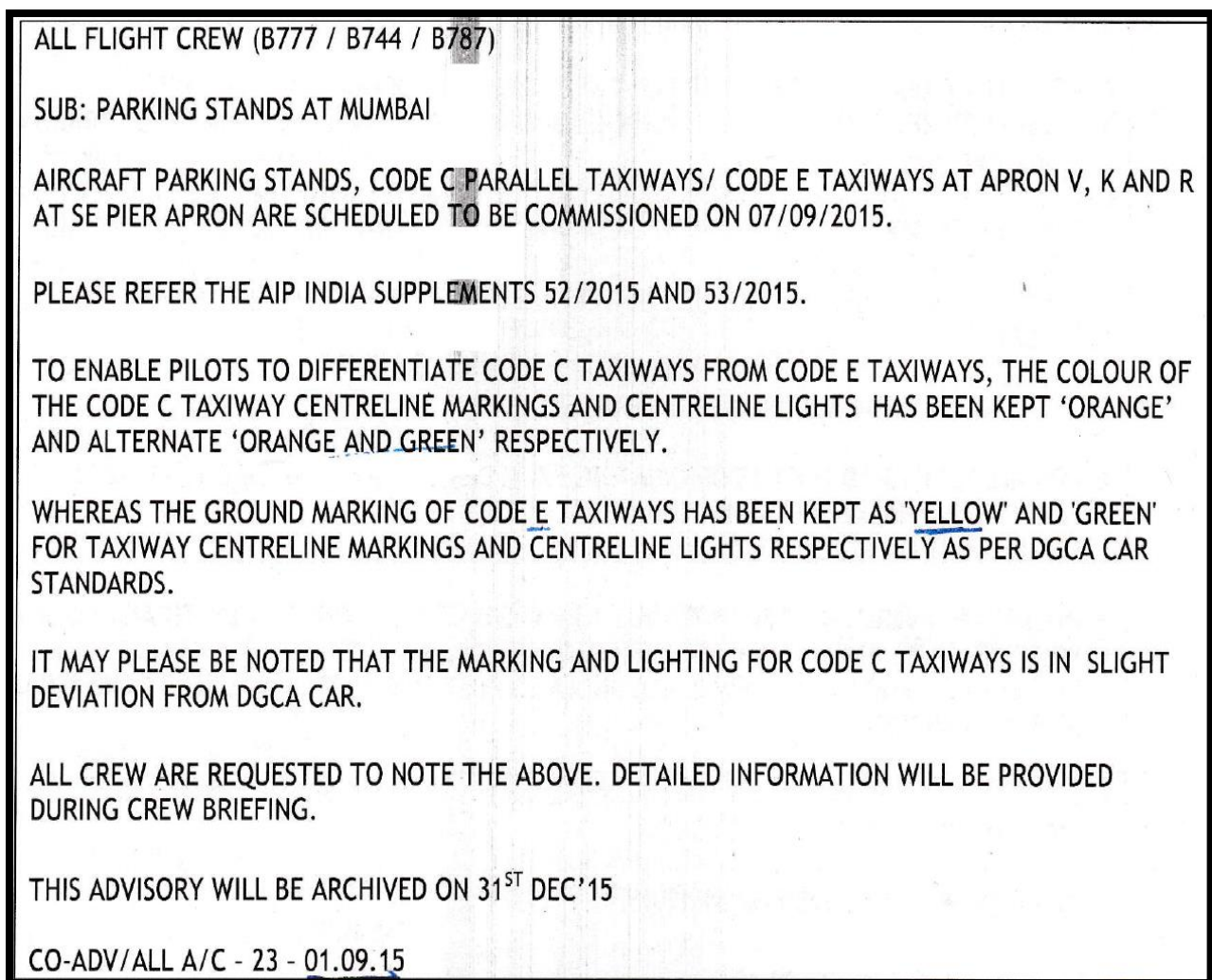


Figure : 8

### 1.17.2 Air India Flight Dispatch

The Air India dispatch office provided following documents to the crew during briefing before flight.

- Copy of AIP 52/2015 dated 22.07.2015
- Crew Advisory 23 dated 01.09.2015
- Copy of Jeppesen dated 15.01.2016.

The briefing provided to the crew of AI191 did not include any information regarding the changes in markings/lightings for operation of Code E and Code C aircraft in South East Pier, owing to introduction of SOP Document No. MIAL/AO-ASM/SOP/17/01, Issue No 4, Rev No 01 dated 12.01.2016. Neither did it include the NOTAM A0056/16 wherein some of these changes were notified.

Various officials of Air India had undergone training program conducted by MIAL regarding the changes that were to be made effective from 12.01.2016, however, no amendments were made in the Crew Advisory 23 dated 01.09.2015 and neither was this information provided to the pilots during pre-flight briefings.

Following is the details of training program conducted by MIAL for officials of Air India and its Flight Dispatch:-

Sl. No.	Date	Subject	Place	No. of Attendees
1.	23.12.2015	Training on change of Marking/Lighting for SE Pier Apron TWYs / Taxi lanes and New Infrastructure commissioning (TWY M8, Portion of TWY M, Stands V20 to Stand V27 and Stand K1)	Air India Flight Dispatch Office, T2	10
2.	24.12.2015	Training on change of Marking/Lighting for SE Pier Apron TWYs / Taxi lanes and New Infrastructure commissioning (TWY M8, Portion of TWY M, Stands V20 to Stand V27 and Stand K1)	Air India Flight Dispatch Office, T2	3

3.	28.12.2015	Training on change of Marking/Lighting for SE Pier Apron TWYs / Taxi lanes and New Infrastructure commissioning (TWY M8, Portion of TWY M, Stands V20 to Stand V27 and Stand K1	Air India Flight Dispatch Office, T2	3
4.	30.01.2016	Briefing on Pushback procedures and other process in SE Pier	Air India Engg. GSD, SE Pier	14

## 1.18 Additional Information

### 1.18.1 ICAO Reference Code of Aircraft

The ICAO Aerodrome Reference Code is a two-part categorisation of aircraft types which simplifies the process of establishing whether a particular aircraft is able to use a particular aerodrome. It is included in ICAO Annex 14. It has two 'elements'. The first is a numeric code based on the "Reference Field Length" for which there are four categories and the second is letter code based on a combination of aircraft wingspan and outer main gear wheel span.

Element 1 of the Code is as follows: -

Code number	Aeroplane reference field length
1	< 800 m
2	800 m but < 1200 m
3	1200 m but < 1800 m
4	1800 m and above

Aeroplane reference field length is defined as "the minimum field length required for take-off at maximum certificated take-off mass, at sea level, in International Standard Atmosphere conditions in still air and with zero runway slope as documented in the Aircraft Flight Manual (AFM) or equivalent document.



The Element 2 of the Code is derived from the most restrictive of either the aircraft wingspan or the aircraft outer main gear wheel span. The categories are as follows: -

<b>Code letter</b>	<b>Wingspan</b>	<b>Outer main gear wheel span</b>
A	< 15 m	< 4.5 m
B	15 m but < 24 m	4.5 m but < 6 m
C	24 m but < 36 m	6 m but < 9 m
D	36 m but < 52 m	9 m but < 14 m
E	52 m but < 65 m	9 m but < 14 m
F	65 m but < 80 m	14 m but < 16 m

It should be noted that Element 2 is often used as it has direct relevance to the detailed airport design. The Boeing 777- 300 ER is categorised as Code 'E' aircraft as it has a wing span of 64.8 meters.

### **1.18.2 SURFACE MOVEMENT CONTROL**

As per the statement of Controller on duty at SMC, he was on duty from 1726 UTC to 2201 UTC on frequency 121.9 Mhz (SMC-1) and 123.75 (SMC-2) on the day of incident. AIC 191 was initially given taxi instructions "N - cross Rwy 14 – N - hold short of M6" after vacating Rwy 27. Further, AI191 was issued taxi instruction to parking bay K5 via "M6 – M - M4 - Y1 - Y3 - stand K5". The instructions were also read back by the crew of AI191.

Controller was aware of Code E aircraft taxi procedure but uttered Y1 instead of H1. He also did not inform Apron Control for providing "follow me" vehicle or switching ON centreline lighting for Code E operations. He was not aware of NOTAM A0056/16

### 1.18.3 Jeppesen Charts used by Crew

The crew was using Jeppesen 10-1P1 dt 15 Jan 2016. The charts were not including/indicating that taxiway Y1 is restricted to Code C aircraft. The taxi procedures as per the Jeppesen is shown in the Figure 9 below: -

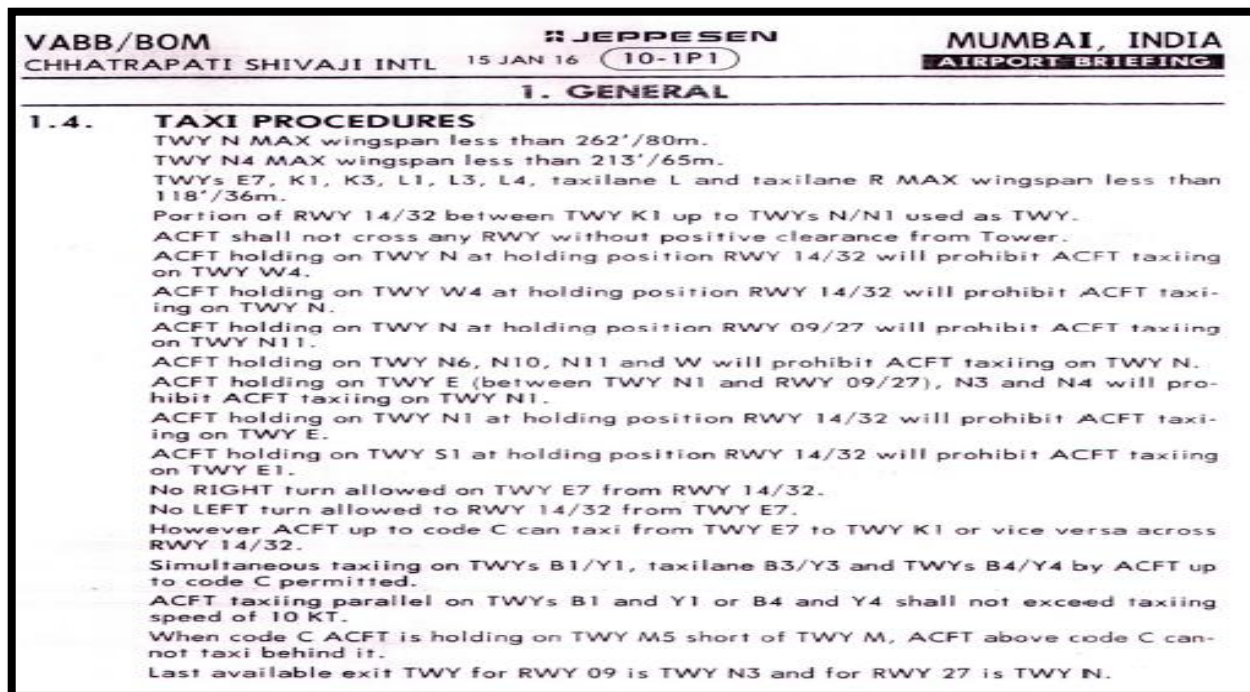


Figure : 9

### 1.18.4 AIP Supplement 53/2015

AIP 53/2015 dated 22.07.2015 w.r.t Commissioning/Decommissioning of aircraft Stands, Taxiways/Taxilanes at South East Pier apron in CSIA, Mumbai, became effective on 17.09.2015 replacing the AIP 52/2015. The details of centreline lighting/markings as per the AIP 53/2015 as well as AIP 52/2015 is as below: -

Design	Location and Direction	C/L & Edge Light And Color/Spacing
H1 (Code E)	From TWY M5 up to northern segment of TWY Link 5, between TWY B1 and TWY Y1	C/L: Provided Color: Green Spacing: 30 m. Max. Edge lights: None
Y1 (Code C)	From TWY M4 up to southern segment of TWY Link 5, Parallel to TWY B1	C/L Provided Color: Alternate Orange and Green Spacing 30 m. Max Edge Lights: None

Further, the suitability of Taxiway and Taxilanes used by AI191 for different category of aircraft as per the AIP is as below : -

Taxiway/Taxilane/ Bay	Category	Taxiway/Taxilane/ Bay	Category
<b>M6</b>	F	<b>Y1</b>	C
<b>M</b>	F	<b>Y3</b>	E
<b>M4</b>	E/F	<b>K5</b>	E

### 1.18.5 NOTAM

NOTAM A0056/16 was issued to notify the changes in markings and lightings at South East Pier. Same is shown in the Figure 10 below:-

NOTAM IN RESPECT OF CHANGE IN MARKING & LIGHTING AT SE PIER		
<b>A0056/16 NOTAMN</b>		
Q) VABF/QMXXX/IV/BO/A/000/999/ A) VABB B) 1601120001 C) PERM E) THE COLOR OF GND MARKING AND LGT OF CODE C TWY/CODE E TAXI LANES AT SE PIER APN WILL NOW BE AS GIVEN BELOW:		
TWY/TAXI LANE/LINKS	COLOR OF TWY/ TAXI LANE CENTRELINE MARKING	LIGHTING
TWYS B1, Y1, B4, Y4, LINK 4, 5 (SOUTHERN TURN) LINK -7.	YELLOW	GREEN
TAXILANE B3, Y3, LINK 5 (NORTHERN TURN), LINK-6	YELLOW	GREEN
PORTION TAXILANE H1 (BETWEEN TWY B1 AND LINK 5,SOUTHERN TURN)	ORANGE INTERRUPTED (BROKEN)	ALTERNATE ORANGE AND GREEN
PORTION OF TAXILANE H3 (BETWEEN LINK 6 UP TO BEHIND STAND V31)?	ORANGE INTERRUPTED (BROKEN)	ALTERNATE ORANGE AND GREEN
PORTION TWY M4 (BETWEEN TWY Y1 AND TAXILANE H1)	ORANGE INTERRUPTED (BROKEN)	ALTERNATE ORANGE AND GREEN
AMEND ANNEXURE 1, PARA 1.16, COLUMN: C/L AND EDGE LIGHT COLOUR/SPACING OF TWY/TAXI LANE C/L MARKING AND LIGHTING AND CHARTS AT ANNEXURES: 1-1, 1-2, 3-1, 3-2 AND 4-1 OF AIP SUP 53/2015 ACCORDINGLY.		

Figure : 10

The crew of AI191 was not provided information of this NOTAM by Air India Flight Dispatch.

### 1.18.6 SOP for operations in South East Pier Area

An SOP Document No. MIAL/AO-ASM/SOP/17/01 Issue No 4 Rev No 01 dated 12.01.2016 existed at Mumbai Airport for managing safe and smooth Code C and Code E operations around South East and North East Pier of the Airport. The SOP mentioned details of Taxiway and Taxilanes in the South East Pier and North East Pier. The details relevant to present report are as below:-

<b>Design</b>	<b>Location and Direction</b>	<b>Color of CL marking</b>	<b>C/L &amp; Edge Light And Color/Spacing</b>
H1 (Code E)	From TWY M5 up to northern segment of TWY Link 5, between TWY B1 and TWY Y1	Yellow up to divergence of TWY B1, then no marking for the 50 m from the divergence of B1 and last 50 m towards Link. Rest of the portion is marked with Orange broken lines.	C/L Provided Color: Green upto divergence of TWY B1, then alternate Orange and Green Spacing 30 m. Max Edge Lights: None
Y1 (Code C)	From TWY M4 up to northern segment of TWY Link 5, Parallel to TWY B1	Yellow	C/L Provided Color: Green Spacing 30 m. Max Edge Lights: None

The SOP was prepared jointly by MIAL and AAI to establish and formalize procedure and operation of centreline lights of Taxiways/Taxilanes B1, Y1, B4, Y4, H1, B3, Y3 and H3. It also described procedure for Code C and Code E aircraft operations around South East and North East Pier.

As per the SOP, Airfield Ground Lighting (AGL) System had two circuits for lighting the centre line lights. Circuit 1 was for Code C aircraft operations and Circuit 2 was for Code E aircraft operations. The AGL system had two modes REMOTE and LOCAL. The responsibility of switching ON circuit 2 for Code E operations rested with ATC if AGL was in REMOTE mode and the same was with CCR if AGL was in LOCAL mode. The AGL system was in LOCAL mode at the time of incident

As per the SOP, the centreline lighting for taxiway H1 was 'Green' up to divergence of taxiway B1 and alternate 'Orange' and 'Green' thereafter. The centreline lighting for taxiway Y1 is 'Green'.

Respective Duty Air Traffic Controllers of AAI in coordination with MIAL were to ensure compliance of the SOP. The procedure included the following: -

- Joint Control Centre (JCC) will inform Apron Control of all Code E aircraft movement planned to operate in SE/NE pier Aprons during the day.
- Apron Control will direct "Follow me" vehicle to take position short of lane change over junction, to provide "Follow me" service to Code E aircraft till its stand. Once Code E aircraft enters its stand, "Follow Me" will terminate its services and inform the same to ATC & Apron Control.

#### **1.18.7 Ground Marking "MAX SPAN 36 M"**

Ground Marking "MAX SPAN 36 M" was available at entry point of taxiway Y1. Crew was able to notice the marking. The image of ground marking is shown in the Figure 11 below: -



Figure : 11

#### **1.19 Useful or Effective Investigation Techniques: NIL**

## **2 ANALYSIS**

### **2.1 Serviceability of the Aircraft.**

The aircraft had a valid Certificate of Airworthiness and a Valid Certificate of Registration on the day of incident. The scrutiny of the Airframe Log book revealed that as on 22.02.2016, the aircraft had completed 32509 Airframe Hours and 4705 Landings.

The aircraft had a technical snag at Ahmedabad prior to its departure as the LH engine could not be started after push back. The aircraft was towed back to bay and LH engine was started. The aircraft was pushed back with one engine "ON" which is as per the procedure laid in B777 SOP. Aircraft serviceability had no bearing on the incident.

### **2.2 Weather**

Weather at the time of incident was fair with a visibility of 3200 metres. While the area was dimly lit, however, the markings on the ground were visible to the crew.

### **2.3 Flight Operations**

Air India Flight Dispatch office was responsible for providing flight briefings to the crew. Following documents were part of crew briefing package provided to crew of AI191.

- Copy of AIP 52/2015 dated 22.07.2015
- Company Crew Advisory 23 dated 01.09.2015
- Jeppesen dated 15.01.2016

Crew did not have any information about changes in Code C and Code E aircraft operations introduced vide SOP Document No. MIAL/AO-ASM/SOP/ 17/01 Issue No 4 Rev No 01 dated 12.01.2016. They were also not provided information about NOTAM A0056/16. The AIP 52/2015 provided to crew had been revoked w.e.f 17.09.2015, when AIP 53/2015 came into effect.

Officials of Air India Flight Dispatch were provided training, on SOP Document No. MIAL/AO-ASM/SOP/ 17/01 Issue No 4 Rev No 01 dated 12.01.2016 and consequent changes, by MIAL. However, the contents of the training were not incorporated into the flight briefing package that was being provided to the pilots. The NOTAM A0056/16 was available on AAI website in the Monthly NOTAM summary dated 01 Feb 2016, but was not a part of briefing package.

The comparison of information about the centre light lighting for Taxiway Y1 and Taxilane H1 given in AIPs, Advisory, MIAL SOP and NOTAM is tabulated below:-

Sr. No.	Document	Centre Line Lighting	
		Taxilane H1	Taxilane Y1
1.	SOP	C/L Provided Color: Green upto divergence of TWY B1, then alternate Orange and Green Spacing 30 m. Max Edge Lights: None	C/L Provided Color: Green Spacing 30 m. Max Edge Lights: None
2.	NOTAM A0056/16	Color: alternate Orange and Green	Color: Green
3.	AIP 52/2015	C/L Provided	C/L Provided
4.	AIP 53/2015	Color: Green Spacing 30 m. Max Edge Lights: None	Color: Alternate Orange and Green Spacing 30 m. Max Edge Lights: None
5.	Advisory 23	Color : Green for Code E Taxiways	Color : Alternate Orange and Green Green for Code C Taxiways

In the absence of proper briefing, crew was not aware of the changes introduced for operations of Code C and Code E aircraft with regard to use of "Follow Me" vehicle or Centreline Lightings. Crew, however, saw the ground marking "MAX SPAN 36M" but continued regardless of the fact that the wing span of their aircraft was 64.8 m.

Improper briefing and not obeying the ground markings were factors in the incident.

## **2.4 Standard Operating Procedures**

As per SOP No. MIAL/AO-ASM/SOP/17/01, Issue No 4, Rev No 01, dated 12.01.2016, ATC was required to inform Joint Control Centre (JCC)/Apron Control of all Code E aircraft movement planned to operate in SE/NE pier. JCC in turn would have directed the "Follow Me" vehicle to take position short of the lane change over junction to provide "Follow Me" service to Code E aircraft till its stand. However, SMC had routed aircraft through taxiway Y1 in place of taxilane H1 and JCC was not informed of movement of AI191 by the SMC.

Airfield Ground Lighting (AGL) System was in "LOCAL" mode at the time of incident. In absence of information from SMC, the CCR did not activate the Circuit 2 for switching on the Centreline Lightings for Code E aircraft operations. As per the statement of crew and CVR recording, the centreline lighting were lit green.

Not following the SOP was a factor in the incident.

## **2.5 Circumstances Leading to the Incident**

At 1943 UTC, the SMC gave clearance to VT-ALJ (AI191) to taxi via "M6 - M - M4 - Y1- Y3 - Stand K5". Taxiway Y1 was not suitable for Code E aircraft. The SMC was aware of SOP but not the NOTAM A0056/16. He had inadvertently given incorrect clearance to VT-ALJ (Code E) via taxiway Y1 in place of taxilane H1. Also, he did not inform JCC for Code E aircraft movement as per the SOP, hence "Follow-me" was not provided to VT-ALJ. There was no instruction to CCR either, by the SMC to switch on lighting for taxilane H1, therefore, taxiway Y1 for Code C aircraft was lit 'Green' at the time of incident. The lights for Code E operations were not switched on.

Cockpit Crew was not aware of the latest NOTAM regarding colour scheme for taxiway centreline lighting. The aircraft followed the taxi instructions and continued towards Stand K5 in the South East Pier. Cockpit Crew noticed the ground marking "MAX SPAN 36M" before entering taxiway Y1, but continued irrespective of the fact that wing span of VT-ALJ was 64.8 m.



The RH wing of the aircraft hit the lamp post while taxiing on the taxiway Y1. In the mean while "Follow me" vehicle joined near parking bay K5 after hearing the SMC transmission about allotment of parking bay K5 (which was meant for Code E) to enquire from ground staff about the aircraft code. The aircraft went on to park at bay K5 and the wing damage was noticed by the crew during post flight check.

### **3 CONCLUSION**

#### **3.1 Findings**

**3.1.1** The aircraft had a valid CoA and CoR on the day of incident and both pilots were qualified on type to operate the flight.

**3.1.2** The crew was not aware of NOTAM regarding color scheme for taxiway centerline lighting and SOP regarding taxiing of aircraft around SE Pier.

**3.1.3** The B 777-300 ER aircraft VT-ALJ is a Code E category aircraft but was given taxi clearance to taxi via "N - Cross RWY 14 - N1 Hold short of M6 - M - M4 - Y1 - Y3" to parking bay K5.

**3.1.4** Crew noticed the ground marking "MAX SPAN 36M" but continued without confirming whether taxi instructions were correct.

**3.1.5** The aircraft hit the High Mast Lighting Pole at a wing height and crew felt a shudder, but were unaware that aircraft had hit the pole. The damage to the wing was beyond the limits prescribed in the Structural Repair Manual.

**3.1.6** Controller at SMC inadvertently uttered "Y1" in place of "H1" while giving taxi clearance and information to JCC or CCR was not passed for providing "Follow-me" service or; switching centerline lights for Code E operations.

**3.1.7** The Controller at SMC was aware of the Taxi procedure for Code E aircraft in South East Pier but not aware of NOTAM A0056/16 regarding change in lightings for Code E and Code C aircraft operations.

### **3.2 Probable Cause of the Serious Incident**

The probable cause of Serious Incident was "In-correct taxi clearance" and "Non- Adherence of SOP for operations in South East Pier".

Contributory factors were as below: -

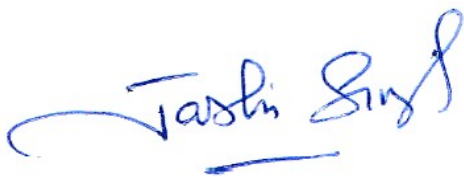
1. Inadequate and Improper Pre-Flight Briefing.
2. Non-Compliance of Ground Warning Sign "MAX SPAN 36 M".

### **4 Safety Recommendations**

**4.1** In the interest of Safety, DGCA may issue safety circular highlighting this incident to address inadequacies in the Flight Dispatch Procedures.

**4.2** Air India may issue Circular highlighting this incident, and review its dispatch procedures for correct and updated briefing. All the crew shall be advised to comply with Ground Markings.

**4.3** AAI and MIAL should review their procedures for circulation of NOTAMS and other such information in view of the fact that neither Air India Dispatch nor the SMC were aware of the latest NOTAM.



(Jasbir Singh Larhga)  
Deputy Director Air Safety, AAIB  
Member COI , VT-ALJ



(Amit Gupta)  
Director (AED),DGCA  
Chairman COI , VT-ALJ

Date: 31-01-2020

Place: New Delhi