

INVESTIGATION REPORT INTO THE CIRCUMSTANCES
AND CAUSE/S OF THE GROUND OCCURRENCE INVOL-
VING PIAC BOEING 737 AIRCRAFT REGISTRATION
AP-BCA THAT OCCURRED AT LAHORE INTERNATIONAL
AIRPORT ON 22ND APRIL 1987 AT 1440 HRS. (P.S.T)

Authority:- Director General C.A.A Telex dated 23rd
April 1987 reference HQ CAA/2651/25/Legal
(Appendix "A").

Investigation Team

AIR CDRE. (RETD) PATRICK D. CALLAGHAN SAFETY ADVISER C.A.A.	INVESTIGATOR IN CHARGE
BRIGADIER (RETD) BASHIRUDDIN SENIOR WORKS ENGINEER ISLAMABAD AIRPORT	INVESTIGATOR
MR. ZAFARULLAH KHAN SENIOR AIRWORTHINESS SURVEYOR LAHORE AIRPORT	INVESTIGATOR

1. AIRCRAFT INFORMATION

1.1.	Registration Marking ...	AP-BCA
1.2.	Aircraft type ..	Boeing 737-300
1.3.	Engine/s type and number..	CFM 56 TWO PYLON MOUNTED ONE UNDER EACH WING
1.4.	Certificate of Registration.	No.576
1.5.	Certificate of Airworthiness.	No.529 Valid 9.6.87
1.6.	Certificate of Maintenance.	Issued 24.1.87 Valid
1.7.	Date of Construction.	29.5.85
1.8.	Owner..	P.I.A C
1.9.	Maximum gross weight permitted.	61235 Kg.
1.10.	C of G ...	Within limits C.G limit 17.57% MAC.
1.11.	Total airframe hours ;	3921.43 hours (on 26.4.87)
1.12.	Engine History....	
1.12.1.	Port engine...	S.No.720-231
1.12.2.	Hours since new	1664.28 hrs/1579 cycles
1.12.3.	Starboard engine..	S.No.720-232
1.12.4.	Hours since new..	3028.54 hours/ 3174 cycles.

2. COCKPIT/...

2. COCKPIT OCCUPANTS

- 2.1. Aircraft Engineer Raza Mohiuddin P.I.A.
P.No.22038 - Left control seat AME-620.
- 2.2. Aircraft Engineer Asadullah Ghalib P.I.A
P.No.22509 - Right Control Seat AME - 780.

3. BRIEF DESCRIPTION OF OCCURRENCE

- 3.1. Boeing 737 Registration AP-BCA Operating Flight PK-381 landed at Lahore International Airport on 22nd April 1987 from Islamabad. With the following snag "On take off from Islamabad after lift off E.G.T of No.1 engine abruptly increased from 870°C to 950°C and tended to increase rapidly if the throttle was not pulled back to 70% N1. However EGT settled down at 830°C after throttle was kept at 70% N1 for two minutes. During cruise all parameters were normal."
- 3.2. Rectification was carried out by Mr. Asadullah Ghalib AME 780 and a ground run for take off power check was required. After the rectification the engineers contacted the Control Tower and requested towing clearance to the run up point (Dumbell 06 is the run up point at Lahore through usage but is not designated as such in any written orders/ communication) Tower were informed that run up would be upto take off power. The controller denied clearance because of V.V.I.P movement. At 13.55 hours P.S.T when the airfield was declared open the controller was again requested for towing clearance of Boeing AP-BCA to the run up area. The controller cleared the aircraft movement and provided the Marshaller Van for necessary guidance.
- 3.3. When the aircraft arrived at the dumbell it was positioned facing into the wind with permission from the tower controller.

3.4. After/....

- 3.4. After completing pre-run up checks permission was obtained from the Tower for engine run up upto take off power. After permission was granted both engines were started and the engines stabilized at idle power for four minutes as per the maintenance manual. Power on both engines was then increased to 80% N1. When both engines were at 80% N1, the No.2 engine was left at this power, and power on No.1 engine was increased towards the target of 92.13% ^{N1} ~~No.1~~, however when power reached approximately 90% N1 on the engine Senior Tech.Mr.Aqil Shah, who was on the ground and in contact with the engineers in the cockpit on intercom, on observing the tarmac peeling off shouted to cut engines immediately. The engineers immediately cut the engines, and on coming down from the aircraft observed that a wide area of tarmac behind No.1 engine had peeled off and had been blown all over.
- 3.5. The engineers on inspecting the aircraft noted that the left hand side of the fuselage had sustained damage at several places, the leading edge of the left stabilizer had also sustained damage, and pieces of debris were lying on the upper surface of the left stabilizer.
- 3.6. The incident occurred at 1449 hours and was immediately reported to the relevant authorities.
- 3.7. After obtaining permission from the Investigator in Charge the aircraft was removed from the scene of occurrence, and PIA were permitted to repair the aircraft. Repair was completed by about 1400 hours on 23.4.87, and after clearance by Airworthiness, the aircraft operated a passenger flight the same evening to Karachi.

4. INJURY/....

4. INJURY TO PERSON(S)

4.1. None.

5. DAMAGE TO AIRCRAFT

5.1. Fuselage Port - Side at station 727C and W/L 190 had skin ruptured of about $\frac{1}{2}$ "X $\frac{1}{2}$ " area.

5.2. Fuselage port-side at Station 847 and W/L 190 had skin ruptured of about 1"X $1\frac{1}{2}$ " area. Around this ruptured spot about $1\frac{1}{2}$ ' X $1\frac{1}{2}$ ' surface area was dented.

5.3. Wing had a slight dent near its left hand trailing edge flap.

5.4. Port side stabilizer sustained dents of approximately 4 inches and 2 inches in length on its leading edge surface.

5.5. Small rubbing signs observed around pitot tube installed on port side of vertical stabilizer. (See photographs Appendices "B" to "B9" and Appendices "C" and "D").

6. OTHER DAMAGE

6.1. Approximately 400 square feet of bitumenised surface of the dumbell had been torn, blown by the jet blast. There was positive evidence that the bitumen had been subjected to heat and subsequent melting before being blown off by jet blast. (See photographs Appendices "B1" to "B9" and Appendix "E" for damage.)

7. METEOROLOGICAL CONDITION

7.1. The aircraft had no intention of flight. At the time of the occurrence engineers were performing a take off power check on the No1 engine. Weather conditions that are relevant are:-

SURFACE Wind SE 12 knots

Temperature 41°C

(See Appendix "F" which is the meteorological report to ATC for 0930 G.M.T i.e. ten minutes before the occurrence.)

8. NAVIGATION & LANDING AIDS.

8.1. Not a factor in this occurrence.

9. COMMUNICATIONS/....

9. COMMUNICATIONS

- 9.1. Not a factor in this occurrence. Intercom with the ground crew normal, other communications with ATC made through Marshalling Vehicle.

10. AERODROME AND GROUND FACILITIES

- 10.1. The facility involved was the dumbell 06 which though not designated as a run up area in any orders or instructions, had through usage over many years become the run up area. Originally this was a concrete surface, but had recently been overlayed with bitumen during work to smooth the riding surface and improve the drainage. The bitumen surface on the dumbell varied from 3.5 cm to 15 cm in thickness. (See Appendix "A" para 1 sub para(4).

11. FLIGHT RECORDERS

- 11.1. The aircraft is fitted with a DFDR and a cockpit voice recorder. These were not read out since read out was not considered necessary in the circumstance of this occurrence.

12. WRECKAGE & IMPACT INFORMATION

- 12.1. The incident occurred on dumbell 06 during run up. The aircraft was examined in situ by Mr. Zafarullah Khan Senior Airworthiness Surveyor. Photographs were taken at this time which was shortly after the incident. With permission from the Investigator in Charge the aircraft was moved to the main Apron and P.I.A Engineers were permitted to commence under supervision of the Senior Airworthiness Surveyor at Lahore Airport. Repairs were completed by 1400 hours on 23.4.87 and the same evening/night after the aircraft was cleared by Airworthiness the aircraft operated a passenger flight to Karachi. Details of damage sustained by the aircraft are at paragraph 5 of this report. (See also Appendices "C" "D" and "G".

13. FIRE

- 13.1. No fire occurred.

14. SURVIVAL/...

14. SURVIVAL ASPECTS

14.1. This was a ground occurrence. There were no heavy impact forces involved nor was there fire. The two occupants exited the aircraft via the normal passenger steps.

15. TEST & RESEARCH

15.1. With assistance of Mr. Rollin W. Chin, Bechtel International Inc., Project Manager, Lahore Runway Project C.A.A, samples from the dumbell bitumen surface were tested. The tests confirmed that the work was well within the users specifications, and in accordance with the user's requirements (See Appendices "H1" and "H2" for test results).

16. OBSERVATIONS

16.1. Except at Karachi no run up bays, specifically built for that purpose exist. In view of this occurrence there is a need to specify run up areas on concrete surfaces, specially in the case of the 737-300 because of the low slung engines, and the suggestion in the Boeing 737 maintenance manual 09-20-00 B01 page 207 Oct 25/84 at para C(2). (See Appendix "J").

16.2. The General Maintenance Manual makes no reference to the type of surface for engine run up.

17. INVESTIGATION

17.1. The occurrence involving P.I.A Boeing 737-300 AP-BCA occurred at 1440 hours (P.S.T) at Lahore International Airport on 22nd April 1987. The Investigation team were appointed and informed on the same day at 1630 hours (P.S.T). Mr. Zafarullah Khan was instructed by the Investigator in Charge to examine the aircraft and the scene of the occurrence, and to ensure that photographs of the damaged aircraft and the scene of accident were taken. Mr. Zafarullah Khan was permitted to remove the aircraft from the scene, and, in his capacity as Senior Airworthiness Surveyor at Lahore, to permit repair to commence to make the aircraft airworthy.

17.2. /The/...

17.2. The Investigator in Charge reached Lahore by 1030 hrs (P.S.T) on 23rd April 1987. After a briefing by Mr. Zafarullah Khan of the condition of the aircraft and the circumstances leading to the occurrence, the Investigators examined Boeing 737-300 AP-BCA which was in the process of repair by P.I.A. engineers under supervision of the Airworthiness officials at Lahore Airport. Repair was well underway at this stage and was completed by about 1400 hours on 23rd April 1987. After clearance by Airworthiness, the aircraft was scheduled to operate a passenger flight from Lahore to Karachi the same evening. Details of damage sustained by the aircraft are at para 5 preceding. (See photographs at Appendices "B2" "B6" "B7" "B8" and "B9". Also see Appendices "C" "D" and "G").

17.3. The photographs of the aircraft taken shortly after the occurrence were examined and the position of the aircraft and damage to the asphalt surface were noted. The scene of occurrence was then visited and a careful examination of the damaged asphalt surface was made. It was noted that the asphalt at one point directly behind the No.1 engine had been heated to melting point, and commencing from this point, which was 14 feet ^(Ground distance) to the rear of No.1 engine exhaust nozzle, an area of approximately 400 square feet of the bitumenised asphaltic surface had been torn away from the original concrete surface of the 06 Dumbell. Thickness of the asphalt layer at this point was noted to be between 3.5 cm and 5.25 cm (See Appendix "E" and "B1" to "B9").

17.4. It was noted that at the position that the aircraft was parked there was an upslope towards the nose resulting in the nose wheel being higher than the main wheels. The upslope was measured and it was found that it was 2% from the main wheels to the nose wheel, resulting in the nose wheel being ten inches higher than the main wheels.

The/.....

The surface had a 0.8% up slope to the point where the asphalt showed signs of melting. (See Appendix "L") These factors resulted in the exhaust core of the engine striking the surface about 21 feet from the exhaust nozzle. (See Appendix "M") At this distance from the exhaust nozzle at take off power the temperature of the exhaust gases would be about 300°F (149°C). It was determined from the Nespak engineers that temperature at which the bituminous overlay would soften ranged from 120°F to 130°F (50°C to 55°C). It was also determined from the Meteorological report issued to ATC for 0930 hours G.M.T (1430 P.S.T) that the surface temperature was 41°C. It is apparent that under these conditions the bitumen would heat to well above 55°C specially during a prolonged engine run, and in view of the low thickness of the overlay, deterioration would occur more rapidly allowing the exhaust blast to get below the overlay and blow it away. On checking the Maintenance Manual for the Boeing 737-300 at page 207 09-20-00 a mention is made that "closer to engine the exhaust gas temperature is high enough to deteriorate bituminous pavement, therefore, concrete surfaces are suggested for run-up areas." No such suggestion was found in the Maintenance Manuals for the B.747, A-300 or B-707 whose engines are much higher, in fact the Manual on pavements at page 390 states "Normally for commercial jet aircraft danger of jet blast is minimal (See Appendix "K")."

- 17.5. The Investigators carefully examined the condition of the flexible overlay. Cores were taken out from three different locations of the bituminous overlay and were tested for compaction. These tests were conducted by M/s Bechtel on request of the Investigators. The test results were compared with the contractual specifications and this comparison confirmed that the work was well within the contractual specifications and in accordance with the users requirements (See Appendices "H1" and "H2" for test results). Note that the specifications are maintained alongwith File No. HQCAA/1901/81/AIB.

17.6. Statements/....

17.6. Statements by the following were recorded concerning the pavement:-

- | | | |
|---------|--|---------------|
| 17.6.1. | Mr.Ejaz Ahmad Bhatti
Resident Engineer NESPAK | Appendix "N1" |
| 17.6.2. | Mr.Tanwir Qamar
Civil Engineer NESPAK | Appendix "N2" |
| 17.6.3. | Mr.Malik Karnal
Material Engineer NESPAK | Appendix "N3" |
| 17.6.4. | Col.Iqbal Hussain Sultan
Chief Engineer CAA(Punjab) | Appendix "N4" |
| 17.6.5. | Mr.G.R.Qadri
Asst.Director (Civil)
Attached with C.E CAA(Punjab) | Appendix "N5" |

Note: Only those attachments considered necessary for purposes of the investigation have been included as Appendices to the report and have been annotated in the statements. All other attachments to the above statements are held alongwith File No.HQCAA/1901/81/AIB for reference if desired.

17.7. Statements by the following persons involved in the incident were recorded:-

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|---------|---|----------|
| 17.7.1. | Mr.Raza Mohiuddin P.No.22038 AME 620
Aircraft Engineer P.I.A.C | App."Q1" |
| 17.7.2. | Mr.Asadullah Ghalib P.No.22509 AME780
Aircraft Engineer P.I.A.C | App."Q2" |
| 17.7.3. | Mr.Mohammed Aqil Shah P.No.36566
Senior Technician P.I.A.C | App."Q3" |
| 17.7.4. | Mr.Mohammed Nawaz Khan P.No.18474
Senior Technician P.I.A.C | App."Q4" |
| 17.7.5. | Questions by the Investigators to
Mr.Raza Mohiuddin and Mr.Asadullah
Ghalib | App."Q5" |
| 17.7.6. | Mr.A.R.Vine ATCO Lahore Airport
DATCO at the time of incident. | App."Q6" |

17.8. In addition to the above witnesses, discussions were held with the Airport Manager, the Zonal Manager, and Group Captain Saeed the previous Zonal Manager. It was determined from these discussions that:-

- 17.8.1. The dumbell had been used for aircraft run-up for many years prior to the overlay, and though not designated

as/.....

- as the run-up area at Lahore Airport.
- 17.8.2. No consideration had been given to the fact that the surface of the dumbell had been overlayed with asphalt.
- 17.8.3. No specifications were available at Lahore Airport laying down the requirements for a run up area.
- 17.8.4. The asphalt layer was basically to improve the riding surface and the drainage. No other requirement had been specified.
- 17.8.5. The work on the dumbell was completed by the 6th September 1986 and came under use soon after.
- 17.8.6. Formal handing/taking over has not been done as some other work in the contract is still in progress.
- 17.8.7. During this period aircraft including C130 have been parked on the dumbell when necessary.
- 17.8.8. During the period that the newly surfaced dumbell has been in use, an A-300 has done an engine run up on the dumbell with no deterioration of asphalt surface.
- 17.8.9. Air Marshal Khursheed Anwar Mirza, the D.G.C.A.A at that time, visited Lahore Airport in April 1986 and inspected the Apron/Taxiway. He desired that the riding quality and surface drainage of the Apron/Taxiway be improved by laying an asphalt layer on the existing pavement.

18. DISCUSSION

- 18.1. Boeing 737-300 Aircraft Registration AP-BCA belonging to P.I.A.C, whilst being given an engine run up to take off power on the number one engine on the Dumbell 06 at Lahore International

Airport/....

Airport on 22nd April 1987, was damaged when a portion of the asphalt overlay surface behind No.1 Engine failed and the asphalt was torn from the original cement concrete surface, and pieces blown by the jet blast struck the fuselage of the aircraft.

18.1.1. Failure of Asphalt Surface. The investigation has concluded that the asphalt overlay conformed to the specifications and the users requirements. The evidence available leads to a conclusion that during the ground run of Boeing 737-300 AP-BCA, the hot jet blast caused deterioration of the asphalt. When its temperature exceeded 50 to 55°C the temperature at which the bitumen softens. The thinness of the asphalt layer in these circumstances, and considering the outside air temperature of 41°C would result in faster heating through to the basic concrete surface and early failure. The attitude of the aircraft at the time of the run up contributed to the failure since it resulted in the impingement of the jet blast at a point much closer to the engine exhaust outlet and consequently a higher jet blast temperature and velocity. (See Appendix "M" and Appendix "L"). After the deterioration of the asphalt surface, the blast getting under the layer caused an area of the surface to be torn and blown away.

18.1.2. Use of Bituminous Pavement for Engine Run-up. The

In the Manual of Pavements at page 390 whilst discussing the effects of jet blast on flexible pavements it is stated "Normally for commercial jet aircraft danger of jet blast is minimal". The suggestion made in the Maintenance Manual for the Boeing 737-300 at page 207 09-20-00 "Closer to the engine exhaust gas temperature is high enough to deteriorate bituminous pavement, therefore concrete surfaces are suggested for run up areas" suggests that such a problem has been experienced with the Boeing 737 aircraft because of its low slong engines.

The/.....

The Maintenance Manuals for the Boeing 707, Boeing 747 and the Airbus A300 do ^{not} ~~nto~~ have any such suggestion.

The General Maintenance Manual of P.I.A makes no mention of the pavement surface required for engine run up.

In the circumstances and in view of the fact that the suggestion to use concrete surfaces could be easily overlooked, no person or persons ~~can~~ ^{can} be blamed. it is advisable that run-up areas for all airports be specified. These run up areas must have concrete surfaces. Where concrete surfaces are not available for run up areas, these must be provided.

The occurrence under investigation, in view of the foregoing, brings out the need for all agencies concerned, including the Engineering Consultants and aircraft operators to co-ordinate with each other and the Airport Staff on specific technical requirements.

- 18.1.3. Users Requirements. The work of laying an asphalt overlay was for the purpose of improving the quality of the riding surface and improvement of drainage. The consultants prepared the specifications and plan for this work. The user should have specified the use he would make of all areas where the work was to be done. Had the user indicated that the dumbell was to be used for parking and engine run up the consultant would have included these requirements in the plan he prepared. Possibly the consultant should have prepared a questionnaire to be filled by the user which would have ensured that all other requirements of the user were indicated. However, the main lesson to be learned from the occurrence is the absolute necessity of the users requirements being spelt out in detail to the consultants to ensure that correct specifications and plans are prepared.

19. FINDINGS

19.1. After considering all the available evidence the Investigators find the following:-

19.1.1 The site of the occurrence marked on the Master Plan of Lahore Airport is the old dumbell at the Confluence of three taxiways (Appendix "O").

19.1.2. Originally the surface of the dumbell at the site of the occurrence was concrete slabs. The LCN was not determined. For as long back as can be rememberd and not less than 15 years, the dumbell had been in use for run ups of engines when required.

19.1.3. During a visit to Lahore Airport in the month of April, 1986, the then DGCAA Air Marshal Khurshid Anwar Mirza directed that a flexible overlay was to be provided on the taxiways to improve the riding surface and drainage. This work was not to improve the L.C.N of existing pavements.

19.1.4. No users requirements were framed and no special conditions other than improvement of the riding surface and drainage were communicated to M/s NESPAK hired as consultants for the designing and supervision of the overlay work.

19.1.5. The work was awarded to M/s Lodigiani & Co.

19.1.6. The work commenced on 5th June, 1986 and the subject portion completed on 6th September, 1986. Since that time it has been in use. Formal handing/ taking over is yet to take place.

19.1.7. The overlay on the dumbell varied from 3.5 cms to 15 cms, and at the place of damage to the overlay on the dumbell, the minimum overlay of 3.5 cms occurred because of drainage requirements.

19.1.8. Various/....

- 19.1.8. Various tests carried out by the consultants M/s NESPAK during the execution phase conformed to the specifications as laid down for this job.
- 19.1.9. M/s.NESPAK were responsible for the designing and quality control of the overlay work, whereas Col.Iqbal Hussain Sultan, Chief Engineer CAA, (Punjab)was overall incharge of the work.
- 19.1.10. The results of the compaction tests conducted on the core samples taken from the vicinity of the site of accident, conformed to the specifications. These tests were conducted by M/s Bechtel on request by the Investigators. These results showed that the quality of the work was of a good standard. (Appendices "H1" and "H2").
- 19.1.11. The overlay work was undertaken only to improve the riding surface and drainage of the area. No strengthening of the existing pavement was done.
- 19.1.12. The consultant had communicated to all concerned that the area could be used by light aircraft (Fokker F-27) occasionally (Appendices "P1" and "P2") However, ^{aircraft} such as the Airbus A-300, Boeing 737 and C130 had been permitted to use the area.
- 19.1.13. The dumbell was not designated as a parking bay or run-up bay, but it continued to be used as such, because of limited space at Lahore Airport and the past practice over a long period prior to the overlay.
- 19.1.14. The slopes in the dumbell area varied from level to upto 2%.
- 19.1.15. On 22nd April, 1987 Boeing 737-300 was permitted by A.T.C Lahore to carry out a run-up of its engine No.1 to take off power at the dumbell. The P.I.A engineers did not question use of the area as it was by usage used for this purpose over a long period. Infact an Airbus A-300 had a few months earlier accomplished engine run-up on the dumbell without any problem or deterioration of the asphalt overlay.

19.1.16. Boeing/....

- 19.1.16. Boeing 737-300 AP-BCA was parked into wind in a position which resulted in the nose wheel being approximately 25 cms(10") higher than the main wheels, an up slope of 2%. This resulted in the aircraft attaining a nose up attitude from the horizontal of 1°-8'-45" i.e. just a fraction over one degree.
- 19.1.17. The nose up altitude, the 0.8% up slope from the main wheels to the rear of the aircraft, and the low slung engines of the Boeing 737-300 contributed to the jet blast striking the pavement much closer to the engines (Appendix "L").
- 19.1.18. The impact of the directed heat and blast of the exhaust gases of the engine on the pavement was at a distance of 6.5 meters (21.45 feet) from the exhaust nozzle of the engine. (Appendix "L").
- 19.1.19. The exhaust impact with the surface of the pavement was directly to the rear of No.1 engine, which was in the process of being advanced to take off power of 92.13% N1, and had reached about 90% N1.
- 19.1.20. The surface of the pavement to the rear of No.2 engine which was at 80% N1 showed no signs of distress.
- 19.1.21. The early deterioration and failure of the ~~overlay behind~~ overlay behind the No.1 engine occurred because of the thinness of the overlay the ambient air temperature of 41°C (106°F), the softening temperature of the bituminous overlay ranging from 120°F to 130°F and it being subjected to a temperature of 300°F and blast gases at a speed of 680 M.P.H.
- 19.1.22. The bituminous overlay initially melted and instantaneously was ripped off due to the blast getting between the overlay and the concrete, thus causing damage to the airframe of the aircraft which was struck by pieces of the asphalt.
- 19.1.23. Having considered all the factors leading to this occurrence no person or persons can be held responsible for culpable negligence.
- 19.1.24. No specific instructions banning the run-up of engines on flexible pavements existed at the time of the occurrence and the notation in the Maintenance Manual for the B-737-300 (App."J") is a suggestion and not a mandatory requirement.

20. RECOMMENDATIONS

20.1. Considering the foregoing investigation, observations, discussion and findings, the Investigators recommend:-

20.1.1. In view of the circumstances and causes leading to the occurrence, there is an immediate requirement for the CAA to specify that high power run-ups of jet engines be accomplished on concrete surfaces only.

Ops
"20.1.2, Designated areas for the purpose of engine run-up are to be allocated by Airport Managers to PIAC. PIAC may then prepare run-up pads at these areas according to requirements."

(See observations of DG, CAA)

20.1.3. Where concrete surfaces are not available for run-up areas, these must be provided as soon as possible.

Ops
20.1.4. The users must ensure that detailed requirements for a work are specified, including the specific purposes to which completed works will be put, when ordering any works.

20.1.5. Engineering consultants or other agencies who have the responsibility for planning the work and preparing the specifications, should elicit from the user all his requirements. A questionnaire may be used for this purpose to ensure that all the users requirements are catered for in the plan and specifications.

20.1.6. In the case of the operational and maintenance requirements, all agencies concerned i.e, the Airport Authorities, the operators, the CAA Engineers, and the consultants, must co-ordinate on all technical requirements, before a work is undertaken on the apron and movement area.

Ops & works
20.1.7. Engine/.....

20.1.7.

Engine run up at low power settings (below 90% N1) may be permitted on bituminous surface subject to compliance with the following conditions:-

PIA, Good
Ops.

- (a) The bituminous overlay is at least 4 inches thick .
- (b) Prolonged engine run up is not performed.
- (c) Aircraft are parked in level position.
- (d) Ambient surface temperature is 35°C or lower.
- (e) Prior to any run up a thorough inspection of the run up area for any apparent deterioration of the bituminous surface is to be made.

APP. B₁



FRONT VIEW OF B. 737 AP-BCA SHRTLY
AFTER THE OCCURRENCE



APP. B₂

VIEW FROM THE LEFT SHOWING PEELED OFF
OVERLAY ARROW POINTS MELTED BITUMIN

APP B₃



THIS VIEW SHOWS THE PEELED OFF OVERLAY



APP. B₄

THIS VIEW SHOWS THE MELTED BITUMIN.
SHOWN AT APPENDIX "B₂"

APP B5



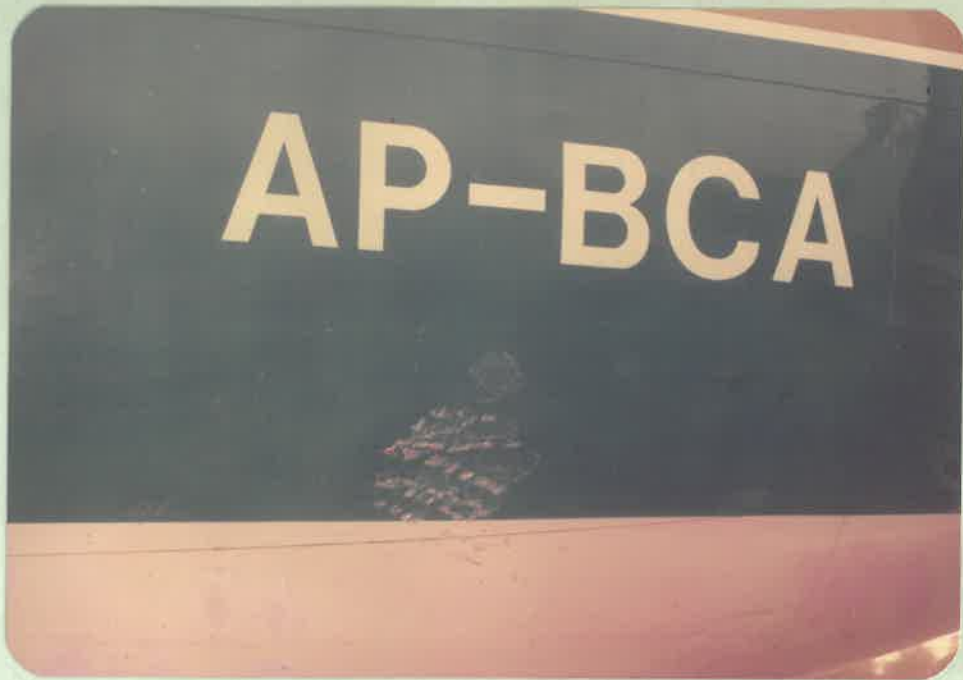
ANOTHER VIEW OF THE FAILED OVERLAY

APP B6



VIEW OF THE LEFT SIDE OF THE AIRCRAFT.
DAMAGE CAN BE SEEN IMMEDIATELY BELOW
THE REGISTRATION MARKING.

APP. B₇⁺



CLOSE VIEW OF ONE AREA OF DAMAGE

APP. B₈⁺



VIEW SHOWING ASPHALT PIECE ON TOP OF
LEFT HORIZONTAL STABILIZER. DENT ON
LEADING EDGE CAN BE SEEN



VIEW OF DENT ON LEADING EDGE OF
LEFT HORIZONTAL STABILIZER.