National Transportation Safety Board
Office of Research and Engineering
Washington, D.C.

January 6, 2000

Airplane Performance Group Chairman's Factual Report

DCA99MA060

I. Accident

Location:	Little Rock, Arkansas
Date:	June 1, 1999
Time:	Approx. 2351 CDT
Aircraft:	McDonnell Douglas MD-82, N215AA
Carrier:	American Airlines

II. Airplane Performance Group

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III. Summary

On June 1, 1999, at approximately 2351 Central Daylight Time (CDT), a McDonnell Douglas MD-82, N215AA, operated by American Airlines as flight 1420, regularly scheduled passenger service from Dallas, Texas, overran the end of runway 4R and collided with the approach light stanchion at the Little Rock National Airport, in Little Rock, Arkansas. The captain and 10 passengers sustained fatal injuries; the remaining 134 passengers and crewmembers sustained various non-life threatening injuries. The airplane was being operated in accordance with 14 CFR 121, and an instrument flight rules (IFR) flight plan had been filed.

Runway tire marks, ground scars, and wreckage positions were measured to the end of the wreckage distribution using tape measures, magnetic compass, and an inclinometer. Tabular and graphical versions of the runway tire mark and ground scar data, along with a 3-view drawing of an MD-80, are presented in Attachment I. The wreckage distribution data are presented in the **Structures Group Chairman's Factual Report**.

Runway surface data (runway grooving geometry, friction coefficients, surface texture depth, transverse and longitudinal gradient, transverse water flow characteristics, and location of rubber deposits) were compiled for runway 4R and are presented in Attachment II.

Landing gear tire tread depths and inflation pressures were also measured. These data are presented in Attachment III.

III. Details of Investigation

A. Runway Tire Marks, Ground Scars, and Wreckage Positions

The Airplane Performance Group arrived on-scene the day after the accident and began documenting runway tire marks, ground scars, and wreckage distribution. Tire marks were found leading from the wreckage area back through the rocks and grass and eventually onto the runway. A coordinate system was established with the origin (0,0) at the centerline of the departure end of the concrete surface of runway 4R. The location of the tire marks, ground scars, and wreckage distribution were then measured relative to this coordinate system. Runway 4R is approximately 7,200 feet long by 150 feet wide.

Tire marks consistent with those of the left main landing gear (lmlg) began 5,228 feet from the end of the runway's concrete surface. These lmlg tire marks began about 1 foot right of runway centerline and continued for 149 feet before ending. Tire marks consistent with those of the lmlg began again at 4,872 feet from the end of the runway's concrete surface at a lateral position of about 13 feet right of runway centerline. These lmlg tire marks continued without further interruption until ending at the edge of a gravel downslope 459 feet beyond the end of the runway's concrete surface. The lmlg tire marks began crossing into the grass on the left edge of the runway about 710 feet before the end of the runway concrete surface.

Tire marks consistent with those of the nose landing gear (nlg) began 5,079 feet from the end of the runway's concrete surface. These nlg tire marks began about 6 feet right of runway centerline and continued for 207 feet before ending. Tire marks consistent with those of the nlg began again at 4,753 feet from the end of the runway's concrete surface at a lateral position of about 18 feet right of runway centerline. These marks continued with occasional interruptions until ending at the edge of the concrete ILS array pad 411 feet beyond the end of the runway's concrete surface. The nose gear tire marks remained on the runway concrete surface until reaching the end of the runway concrete surface approximately 67 feet left of runway centerline.

Tire marks consistent with those of the right main landing gear (rmlg) began 4,303 feet from the end of the runway's concrete surface. These rmlg tire marks began about 47 feet right of runway centerline and continued without interruption until ending at the edge of a gravel downslope 459 feet beyond the end of the runway's concrete surface. The rmlg tire marks began crossing into the grass on the left edge of the runway about 465 feet before the end of the runway concrete surface. The left and right main landing gear tire marks were approximately 98 and 82 feet left of runway centerline, respectively, when they crossed the end of the runway/taxiway concrete surface.

All runway/taxiway tire marks discussed above were more whitish in color than the surrounding off-white concrete surface. When the tire marks crossed white runway paint markings, the white paint was cleaner and whiter than the

surrounding paint. When the tire marks crossed black runway paint markings, there were no white marks but the black paint was cleaner and blacker than surrounding paint. Most of the tire marks were more visible at the outer edges of each tread.

All tire mark and ground scar data are presented in Attachment I in tabular and graphical formats. The wreckage distribution data are presented in the **Structures Group Chairman's Factual Report**.

B. Runway Surface Data

Data concerning runway grooving geometry, friction coefficients, surface texture depth, transverse and longitudinal gradient, transverse water flow characteristics, and location of rubber deposits were compiled for runway 4R starting the day after the accident. Data concerning the runway's transverse water flow characteristics were compiled on November 16, 1999.

Runway 4R's transverse grooving extends from centerline to approximately 13 feet from each runway shoulder. Spacing between grooves was approximately 2 inches, average groove depth was 0.19 inches, and average groove width was approximately 0.25 inches.

Runway 4R's wet friction coefficients were measured using Dallas-Fort Worth Airport's SAAB test vehicle at 40 and 60 mph speeds. The average friction coefficient was 0.69 at 40 mph and 0.55 at 60 mph.

Average surface texture depths for runway 4R's clean, grooved and ungrooved sections were 0.0550 inches and 0.0145 inches, respectively. Average surface texture depth for runway 4R's rubber-coated, grooved touchdown area was 0.0499 inches. Average surface texture depth for runway 22L's rubber-coated, grooved touchdown area was 0.0550 inches.

Runway 4R's average transverse gradient was measured at 1.42%. Engineering drawings for runway 4R show varying longitudinal gradients between 0.000% and 0.318%.

Runway 4R's transverse water flow characteristics were measured via water drainage tests on November 16, 1999 (see data contained in Attachment II). Little Rock Airport personnel indicated that since the day of the accident, no rubber removal treatments had been performed on this runway but the runway 22L threshold paint markings had been repainted together with some of the first 500 foot paint markings. Winds were calm during the water drainage tests. The water drainage tests involved the release of an approximate volume of water from a tanker truck hose onto the centerline of the runway at 100 and 500 foot increments down the runway, starting at 5,608 feet before the end of the runway 4R concrete

surface (just prior to the initial lmlg tire marks). Back-to-back tests were performed at each increment so that dry and wet runway drainage data were obtained. Times for the lateral water flow to reach each concrete slab expansion joint (about 19 feet apart) and the runway shoulder edge were recorded. A time was also recorded for the end of the bulk water flow at the runway shoulder edge. See Attachment II for tabular listings of the water drainage test data.

The water drainage test data for runway 4R indicate that the average flow rate to the left and right shoulder edges when the surface was initially dry were 0.767 and 0.752 ft/sec, respectively. The data further indicate that the flow rate to the left and right shoulder edges when the surface was wet were 0.851 and 0.828 ft/sec, respectively (about 10% higher than the dry rates). Assuming no winds and using the measured runway 4R/22L crossfall slope and surface texture values presented above, NASA data (see graph in Attachment II) indicates that runway 4R/22L is capable of handling rainfall rates up to 1.4 inches per hour (in/hr) before surface flooding (water depth reaching 0.1 inches and greater) occurs at 15 feet from centerline. Crosswinds from the left side of runway 4R, as existed at the time of the accident, would result in deeper water and flooding closer to centerline on the left side of the runway. Similarly, such left crosswinds would result in shallower water and less flooding on the right side of the runway.

Light to medium rubber deposits were observed on runway 4R, with the medium deposits located near the touchdown areas at both ends. The 22L touchdown area had more rubber deposits than the 4R touchdown area.

All runway surface data collected by the Airplane Performance Group are presented in Attachment II. Additional runway surface data is presented in the **Airport Group Chairman's Factual Report**.

C. Landing Gear Tire Tread Depths And Inflation Pressures

Landing gear tire tread depths and the inflation pressures were measured 3 days after the accident. Tread depths varied between 0.094 and 0.313 inches. Only the outboard right main gear tire was inflated upon inspection, and was found to have an inflation pressure of 195 pounds per square inch (psi). All other tires were deflated due to accident damage.

All landing gear tire tread depth and inflation pressure data collected by the Airplane Performance Group are presented in Attachment III

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Charles Pereira
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Attachments