

**CIVIL AVIATION SAFETY
INVESTIGATION REPORT
PUBLIC VERSION**

Right Main Landing Gear Separation Following Landing

Boeing 737-400, registration JY-JAQ
Kabul International Airport, Afghanistan
10 December 2016

PUBLICATION NOTICE

This public version has been prepared for safety-learning and transparency purposes. Personal identifiers, licence numbers, medical details, protected recorded information, proprietary extracts, and material not necessary to understand the safety issues have been omitted or generalized. The sole objective is prevention. This report is not intended to apportion blame or liability.

Issued by the Jordan Civil Aviation Regulatory Commission (CARC)
Aircraft Accident Investigation function

Publication Basis and Scope

This document is a publication-ready public version of the investigation record. It preserves the occurrence sequence, evidence relevant to safety, analysis, conclusions, and safety action while minimizing disclosure of information that is unnecessary for prevention.

Annex 13 principle

The sole objective of an aircraft accident or incident investigation is the prevention of accidents and incidents. It is not the purpose of the activity to apportion blame or liability.

Information withheld or generalized

- Names and direct personal identifiers of flight crew, cabin crew, passengers, engineers, witnesses, and investigators.
- Dates of birth, licence and medical certificate numbers, personal employment histories, and individual medical or toxicological information.
- Cockpit voice recorder audio and transcript content beyond the operational facts necessary for the safety analysis.
- Serial numbers and component-level commercial details not necessary to identify the safety issue.
- Internal consultation correspondence and proprietary manufacturer text. Relevant technical conclusions are paraphrased.
- Photographs or graphics that could identify individuals or expose protected, security-sensitive, or proprietary information.

ICAO framework used

The structure follows the final-report framework in Annex 13: factual information, analysis, conclusions, and safety recommendations. Publication and de-identification decisions were also informed by ICAO Doc 9756, Part IV - Reporting, and the Annex 13 provisions on protection of investigation records. Any use of this report outside its preventive-safety purpose should preserve this context.

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1. Executive Summary

On 10 December 2016, a Boeing 737-400 operating a scheduled passenger flight from Herat to Kabul landed on Runway 29 at Kabul International Airport. Shortly after touchdown, strong vibration developed in the right main landing gear. The right main landing gear separated, and the aircraft continued along the runway supported by the left main landing gear and the right engine nacelle. An emergency evacuation was completed without reported injury.

Occurrence classification	Accident - substantial aircraft damage
Date and time	10 December 2016, approximately 07:58 UTC
Location	Runway 29, Kabul International Airport, Afghanistan
Aircraft	Boeing 737-400, JY-JAQ
Operation	Scheduled passenger service under wet lease
Persons on board	173
Injuries	None reported
Aircraft damage	Substantial; right main landing gear separated and right engine nacelle and adjacent structure were damaged

Most probable cause

The investigation determined that a main landing gear shimmy developed after touchdown. The landing gear remained relatively extended during the initial ground-contact period, leaving the torsion-link and shimmy-damper geometry in a condition of reduced mechanical advantage. The oscillation progressed until right main landing gear components failed and the gear separated.

Contributing factors

- High-elevation aerodrome conditions, which increased true airspeed and ground speed for a given indicated airspeed.
- High touchdown ground speed.
- A low-energy-transfer, soft touchdown that delayed full shock-strut compression and prolonged the period of reduced shimmy-damper effectiveness.
- Operational factors during the approach, including tailwind/crosswind, a 3.5-degree glide path, elevated approach speed, and deviations from stabilized-approach criteria.

2. Factual Information

2.1 History of the flight

The aircraft departed Herat Airport at approximately 07:00 UTC for Kabul. It carried 164 passengers and nine crew or other operating personnel, for a total of 173 persons. The aircraft was configured with flaps 30 for an instrument approach to Runway 29.

The crew received weather information indicating generally suitable visibility and cloud conditions. Wind information available during the approach varied by source and time. The landing clearance included a wind report of approximately 190 degrees at 15 knots. Recorded data indicated a left-quartering tailwind during the approach.

The aircraft touched down well beyond the runway threshold at high ground speed. Shortly after initial main-wheel contact, occupants felt strong vibration. The right main landing gear then separated. The aircraft settled onto the right engine nacelle and came to rest near the far end of the runway, left of the centreline. The flight crew declared an emergency and ordered an evacuation through the left-side exits. All occupants evacuated and no injuries were reported.

2.2 Damage and survival

- The right main landing gear detached from the aircraft.
- The right inboard trailing-edge flap and nearby structure were damaged by separated components.
- The underside of the right engine nacelle was substantially damaged during the runway slide.
- The runway surface sustained localized damage.
- Airport rescue and firefighting personnel responded and applied foam in the area of the right engine.

- The evacuation was completed in less than approximately one minute, according to the investigation record, with no reported injury.

2.3 Personnel

The operating pilots held the required licences, ratings, medical certification, and recent proficiency checks. The investigation did not identify flight-time or rest limitations as a contributing factor. Personal details have been removed from this public version.

2.4 Aircraft and maintenance

The aircraft held valid registration and airworthiness documentation and was within its approved weight and balance envelope. No in-flight system abnormality relevant to the occurrence was reported. Maintenance records showed that scheduled landing-gear inspections were included in the approved maintenance programme. The aircraft had deferred defects at the time of the occurrence, but none were recorded as relating to the landing gear.

The record also identified documentation issues in historical task-card completion and follow-up associated with landing-gear servicing. Because damaged components were not available for complete laboratory examination, the investigation could not conclusively determine whether a specific pre-existing component condition initiated or aggravated the shimmy.

2.5 Aerodrome and meteorology

Kabul International Airport is at an elevation of approximately 5,877 ft. Runway 29 is approximately 3,500 m long and uses an instrument landing system with a glide path of about 3.5 degrees. High elevation increases true airspeed and ground speed relative to indicated airspeed. The aerodrome is also associated with changing winds and wind-shear risk.

2.6 Recorded information

The aircraft was equipped with a flight data recorder and cockpit voice recorder. The recorders were recovered and data were used in the investigation. The flight data were independently analysed with technical assistance. This public report presents only the operational facts necessary for the safety findings and does not reproduce protected cockpit recordings.

Landing weight	Approximately 123,100 lb; near the maximum design landing weight stated in the investigation record
Calculated reference speed	Approximately 142 kt for the recorded weight and flap setting
Touchdown computed airspeed	Approximately 158 kt, or VREF + 16
Touchdown ground speed	Approximately 178 kt
Touchdown position	Approximately 3,500 ft / 1,067 m beyond Runway 29 threshold
Touchdown attitude	Approximately 0.4 degrees nose-up and 1 degree right bank
Initial recorded closure rate	Approximately 3 ft/s at the aircraft centre of gravity; the report also identified a very soft gear-loading condition during the transition to ground mode
Final stopping position	Estimated approximately 10,450 ft beyond the threshold and about 20 ft left of centreline

2.7 Wreckage and runway evidence

The right main landing gear torsion-link and shimmy-damper area showed major failure. Oscillating tire marks and repeated runway-contact marks were consistent with a severe shimmy event. The gear separated during the landing roll, after which the right engine nacelle contacted the runway. A complete accident-site distribution diagram and full laboratory examination of all damaged parts were not available to the investigation.

3. Analysis

3.1 Approach stability and energy

Below 1,000 ft radio altitude, recorded descent rates repeatedly exceeded 1,000 ft/min. A brief enhanced ground-proximity warning-system “SINK RATE” alert occurred below approximately 160 ft above aerodrome level. At a high-elevation airport and on a 3.5-degree glide path, a descent rate slightly above 1,000 ft/min may be needed at high ground speed. Even so, the combined deviations in speed, vertical path, and energy management required active assessment against the operator’s stabilized-approach criteria and go-around policy.

The aircraft crossed the threshold with significant energy and touched down approximately 1,067 m beyond the threshold. The touchdown occurred at approximately 158 kt computed airspeed and 178 kt ground speed. The prolonged flare reduced vertical energy, but it also produced a soft touchdown and delayed firm shock-strut compression.

3.2 Shimmy mechanism

Main landing gear shimmy is a rapid torsional oscillation of the landing-gear inner cylinder, wheels, and torsion-link assembly. The shimmy damper is intended to absorb this energy. Its mechanical effectiveness is lower when the shock strut is extended and the torsion links remain close to a vertical geometry. A high-speed touchdown with low vertical loading can therefore leave the gear vulnerable for longer after wheel contact.

Recorded acceleration fluctuations began around initial main-gear contact and increased sharply at the time corresponding to right-main-gear separation. The aircraft then rolled right and settled onto the right engine nacelle. Runway tire marks, component damage, and recorded accelerations collectively support a severe right-main-gear shimmy followed by structural failure.

3.3 Maintenance considerations

Shimmy susceptibility can be affected by free play at the torsion-link apex joint, worn bushings, air in the damper, incorrect servicing, shock-strut over-servicing, damper

damage, or installation discrepancies. The maintenance programme contained applicable inspections, and no active landing-gear defect had been reported. However, limited component examination prevented a definitive exclusion of every pre-existing mechanical condition. The occurrence therefore demonstrates the importance of rigorous inspection, servicing, task-card sign-off, and follow-up checks.

3.4 Evacuation and response

The emergency declaration, evacuation command, cabin response, and rescue and firefighting attendance resulted in the safe evacuation of all persons on board. No injury was reported. The use of left-side exits avoided the damaged right side of the aircraft.

4. Conclusions

4.1 Findings

4.1.1 The pilots were properly licensed, medically certified, and qualified for the aircraft type.

4.1.2 The aircraft had valid registration and airworthiness documentation and was within its approved weight and balance envelope.

4.1.3 No relevant aircraft-system abnormality was reported in flight before touchdown.

4.1.4 The approach involved elevated speed, high ground speed, a tailwind/crosswind component, and descent-rate deviations.

4.1.5 The aircraft touched down approximately 1,067 m beyond the Runway 29 threshold at about 158 kt computed airspeed and 178 kt ground speed.

4.1.6 The touchdown and early landing roll allowed the right landing-gear shock strut to remain relatively extended, reducing the shimmy damper's mechanical advantage.

4.1.7 Oscillating runway marks, wreckage damage, and recorded accelerations were consistent with a severe right-main-landing-gear shimmy.

4.1.8 The right main landing gear failed and separated; the aircraft then continued on the left main gear and right engine nacelle.

4.1.9 The speedbrakes deployed after touchdown.

4.1.10 No landing-gear-related deferred defect was recorded, but historical maintenance-documentation discrepancies were identified.

4.1.11 Full laboratory examination of the failed components was not available, limiting the ability to identify or exclude a specific pre-existing mechanical initiator.

4.1.12 The emergency evacuation was successful and no injuries were reported.

4.2 Cause

Most probable cause

A severe right main landing gear shimmy developed after touchdown and progressed to landing-gear failure and separation. The relatively extended shock-strut and torsion-link geometry during the initial ground-contact period reduced the shimmy damper's mechanical advantage and allowed the oscillation to build.

4.3 Contributing factors

- High aerodrome elevation.
- High touchdown ground speed.
- Touchdown airspeed above the calculated reference speed.
- Soft touchdown and delayed full shock-strut compression.
- Approach-energy and stability factors, including wind, glide-path angle, descent-rate exceedances, and extended flare.

5. Safety Recommendations and Action

CARC issued safety communication to Jordanian operators of Boeing 737 Classic aircraft addressing prevention of main landing gear shimmy. For public-safety use, the principal actions are summarized below.

Addressee	Recommended preventive action
Operators	Reinforce stabilized-approach criteria and a positive go-around policy whenever required parameters are not established or maintained.
Operators	Include high-elevation, steep-glide-path, tailwind/crosswind, and high-ground-speed hazards in route and aerodrome competence and briefing material.
Flight crews	Avoid attempts to achieve an excessively soft touchdown. Use normal landing technique, ensure speedbrakes are armed, and confirm prompt deployment after touchdown.
Maintenance organizations	Apply manufacturer inspections for torsion-link free play, apex-joint condition, shimmy damper condition and bleeding, shock-strut servicing, and correct installation.
Operators and maintenance organizations	Ensure maintenance task cards are fully signed, independent-stage checks are traceable where required, and post-servicing follow-up inspections are documented.
Operators	After suspected shimmy, hard landing, abnormal vibration, or unusual tire marks, remove the aircraft from service pending inspection in accordance with

Addressee	Recommended preventive action
	approved maintenance data.
Regulator	Monitor operator implementation through surveillance of training, aerodrome qualification, maintenance records, and recurrent inspection programmes.

Status note

This public version summarizes recommended preventive action. CARC should maintain the authoritative recommendation register, addressee responses, implementation evidence, and closure status separately and update the website when recommendation status changes.

END OF PUBLIC REPORT

This report is issued solely to support aviation-safety learning and prevention. It shall not be used to assign blame or determine liability.