



**KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA**

FINAL

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Aircraft Serious Incident Investigation Report

PT. Nusa Flying International

Cessna 172P; PK-NIZ

Adi Soemarmo International Airport

Republic of Indonesia

16 November 2016

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This Final Report was published by the Komite Nasional Keselamatan Transportasi (KNKT), Transportation Building, 3rd Floor, Jalan Medan Merdeka Timur No. 5 Jakarta 10110, Indonesia.

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Jakarta, 31 January 2023

**KOMITE NASIONAL
KESELAMATAN TRANSPORTASI
CHAIRMAN**



SOERJANTO TJAHJONO

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ABBREVIATIONS AND DEFINITIONS

C of A	:	Certificate of Airworthiness
C of R	:	Certificate of Registration
CPL	:	Commercial Pilot License
Km	:	Kilometer
KNKT	:	<i>Komite Nasional Keselamatan Transportasi</i>
PF	:	Pilot Flying
PSC	:	Pilot School Certificate
MLB	:	Maintenance Log Book
SM	:	Service Manual
SOP	:	Standard Operating Procedure
SPL	:	Student Pilot License
UTC	:	Universal Time Coordinated

SYNOPSIS

On 16 November 2016, a Cessna C172P aircraft registered PK-NIZ was being operated by Nusa Flying International to conduct touch and go flight training at Adi Sumarmo Airport (WAHQ), Solo.

At 0317 UTC, the aircraft took off from runway 26 and joined left downwind and made holding on downwind due to traffic. The first student pilot performed two touch and go exercises and afterward the second student pilot acted as pilot flying. The third and fourth touch and go exercises were uneventful.

The weather during this flight was reported clear, the wind condition was calm and the visibility was 6 to 7 km.

The pilot received clearance for the fifth touch and go and the aircraft touched down. After the nose wheel touched on runway, the pilot felt the aircraft vibrated and the instructor took over the control. The instructor assumed that the vibration was caused by flat tire. The instructor recovered and maintain the nose up attitude by increased engine power and slightly pulled the control column.

When the aircraft was passing grass taxiway number 1, the pilot of another aircraft that was holding on short runway noticed that the aircraft rolled at high nose attitude without nose wheel. When approaching taxiway C, the pilot lowered the nose and stopped the aircraft. The pilots shut down the engine and commanded the student to evacuate. No one was injured as a result of this occurrence and the aircraft had minor damage.

The last maintenance on the nose wheel assembly was to repair on the shock strut and was performed 8 days prior to the occurrence flight. The detached of the nose wheel indicated that the castellated nut had been loosening and detached from the axle stud. The loosening castellated nut indicated that the cotter pin was not installed or eventually missing.

The KNKT acknowledges the safety actions taken by the operator and considered that the safety actions were relevant to improve safety and encourage the implementation of the safety actions.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 16 November 2016, a Cessna C172P aircraft registered PK-NIZ was being operated by Nusa Flying International to conduct touch and go flight training at Adi Sumarmo Airport (WAHQ), Solo¹.



Figure 1: The archive photo of PK-NIZ aircraft

Prior to flight, two student pilots and instructor conducted preflight check and there was no abnormality of the aircraft system found.

At 1006 LT (0306 UTC²), the pilot requested to Adi Sumarmo Tower controller (the controller) for start engine and at 0310 UTC, the pilot requested for taxi to runway 26 via fillet (grass taxiway) number one. The first student pilot acted as pilot flying (PF) occupied left pilot seat, the flight instructor occupied right pilot seat and the second student pilot sat on the passenger seat.

At 0317 UTC, the aircraft took off from Runway 26 then joined left downwind and made holding on downwind due to traffic. The first student pilot performed two touch and go exercises and afterward the second student pilot acted as pilot flying. The third and fourth touch and go exercises were uneventful.

The weather during this flight was reported clear, the wind condition was calm and the visibility was between 6 up to 7 km.

Approximately 0509 UTC, the aircraft touched down for fifth touch and go exercise, after the nose wheel touched on runway, the pilot felt the aircraft vibrated and the

¹ Adi Soemarmo International Airport (WAHS), Solo will be named as Solo for the purpose.

² The 24-hours clock in Universal Time Coordinated (UTC) is used in this report to describe the local time as specific events occurred. Local time is UTC+7 hours

flight instructor took over the control. The flight instructor recovered and maintain the nose up attitude by increasing engine power and slightly pulling the control column. The flight instructor assumed that the vibration was caused by a flat tire.

Thereafter, the pilot requested full stop landing and was instructed by the controller to exit via taxiway C. The pilot also requested assistance from Adi Soemarmo tower controller to observe the nose wheel condition.

When the aircraft was passing grass taxiway number 1, the pilot of another aircraft that was holding on short runway noticed that the aircraft rolled at high nose attitude without nose wheel and attempted to inform the controller. The controller asked to the controller assistant to observe the aircraft condition with binocular. The controller assistant noticed that the nose wheel had detached.

When approaching taxiway C, the pilot lowered the nose and stopped the aircraft. The pilots shut down the engine and commanded the student to evacuate. No one was injured as a result of this occurrence and the aircraft had minor damage.

1.2 Personnel Information

The Flight Instructor was male Indonesia pilot, 47 years old and held valid medical certificate, Commercial Pilot License (CPL) and instrument rating. The total of flying experiences was 5,703 hours including 2,600 hours on type.

The first student pilot was male, 18 years old. The first student pilot started the training since 19 April 2016 and held valid Student Pilot Licence (SPL) and medical certificate. The total flying experience was 9 hours 30 minutes.

The second student pilot was male, 19 years old. The second student pilot started the training since 19 April 2016 and held valid Student Pilot Licence (SPL) and medical certificate. The total flying experience was 12 hours.

1.3 Aircraft Information

1.3.1 General

The aircraft registered PK-NIZ manufactured by Cessna Aircraft Company in United States of America in 1981 with the type/model was Cessna 172P and serial number 17275012. The aircraft had a valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R) with total hour of 13,772 hours and 20 minutes.

The aircraft was not equipped with a flight recorder, neither required by current Indonesia regulation for this type.

The aircraft engine was manufactured by Textron Lycoming in the United States of America. The type/model was O-320-D2J with serial number L-100000-39A. The engine was installed on 3 May 2016 and the total hour of the engine was 332 hours and 45 minutes since the last overhaul.

1.3.2 Nose landing gear

On 7 November 2016, a flight instructor conducted cockpit introduction to some student pilots and found hydraulic leak on the aircraft nose landing gear and the strut flat. The instructor reported to the engineer of this condition. The nose landing gear was repaired on the following day.

The repair process included the removal and reinstallation of the nose wheel refers to Cessna 172 Series Service Manual (SM) chapter 5-38 and 5-45.

The investigation could not find any record or work documentation of the repair in the Maintenance Log Book (MLB).

The aircraft installed with the nose wheel manufactured by McCauley. The detail instruction installation was as follows:

- a. Install axle tube in nose wheel.
- b. Install nose wheel assembly in fork and install nose wheel axle stud.
- c. Tighten axle stud until a slight bearing drag is obvious when wheel is rotated. Back the nut off to the nearest castellation and insert cotter pins³.

1.4 Aerodrome Information

Adi Soemarmo international airport was a civil enclave airport operates by PT. Angkasa Pura I which located in Central Java. The airport serves schedule commercial and training flight of civil and military flying school. The runway dimension was 2,600 meters length and 45 meters width and the surface was asphalt. The runway designation number was 08-26.

1.5 Wreckage and Impact Information

Metal scratch marks were found at touchdown area with approximately 8 meters length. The nose wheel axle stud⁴ (axle stud) was found on runway surface approximately 500 meters from runway threshold. The axle through bolt was found, with condition of the one end of the axle stud nut was still intact including its cotter pin while the other end was found without the nut and its cotter pin.

The nose wheel was found at runway shoulder at approximately 750 meters from runway threshold.

³ Cotter pin also known as a split pin, is used to prevent nuts from turning on bolts and to keep loosely fitting pins in place. See chapter 1.6.1 in this document.

⁴ The axle stud in Cessna 172 nose wheel assembly is a stud passing through all the nose landing gear fork and wheel which it binds or in which it is fixed and made fast by a nut at each end of the stud.



Figure 2: the nose wheel axle components (castellated nut, washer and cotter pin) found on runway separately

The metal scratch marks approximately 15 meters length, found approximately 2,100 meters from runway threshold near to taxiway C.

The nose wheel fork found scrap for about 5 centimeters and the propeller tip found bent forward for about 10 centimeters.

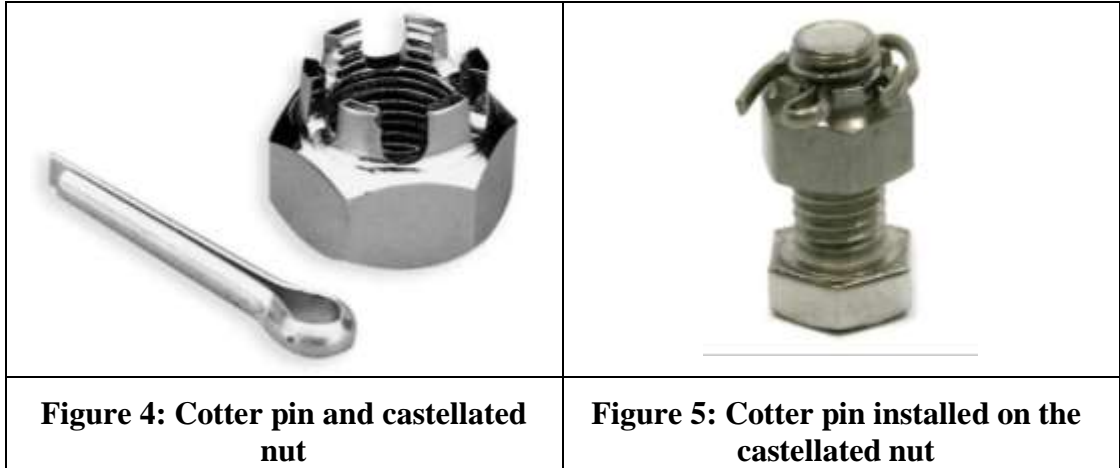


Figure 3: The scrap on nose wheel fork

1.6 Tests and Research

1.6.1 The Cotter Pin and Castellated Nut

Cotter pin also known as a split pin, is used to prevent nuts from turning on bolts and to keep loosely fitting pins in place.



The cotter pin usually used with castellated nut where the head of the nut has radial slots aligned with one of the radial holes in the bolt. The pin is a loose fit in the hole and is kept in place by spreading the ends as shown on the figure 5.

The Cotter pin in Cessna 172 family as listed in the Illustrated Part Catalogue with part number MS24665 was made of carbon steel or corrosion resistant steel.

COTTER PINS (MS24665)		
MATERIAL	TEMPERATURE	USE
Carbon Steel	Up to 450°F	Pins that contact cadmium-plated surfaces. General Applications Normal Atmospheres
Corrosion-Resistant	Up to 800°F	Pins that contact corrosion-resistant steel. Corrosive atmospheres

Figure 6: Cotter pin of Cessna 172

1.6.2 The Axle Stud Examination

The axle stud exhibit bend approximately 10° at approximately 8 centimeters from short end.



Figure 7: The axle stud

At the end of the axle stud where the nut was missing, the thread experienced in contact with hard object damaging 11 threads from the end of the axle stud.

The examination to the cotter pin hole revealed that the hole was contaminated with dirt like grease residue and dust as seen on the figure below.



Figure 8: The dirt in the hole of the axle stud

The examination of the hole under the microscope was difficult to determine the trace of a cotter pin because comparing with the other end of the axle stud where the cotter pin was installed revealed the same imagery as shown in the figure below.

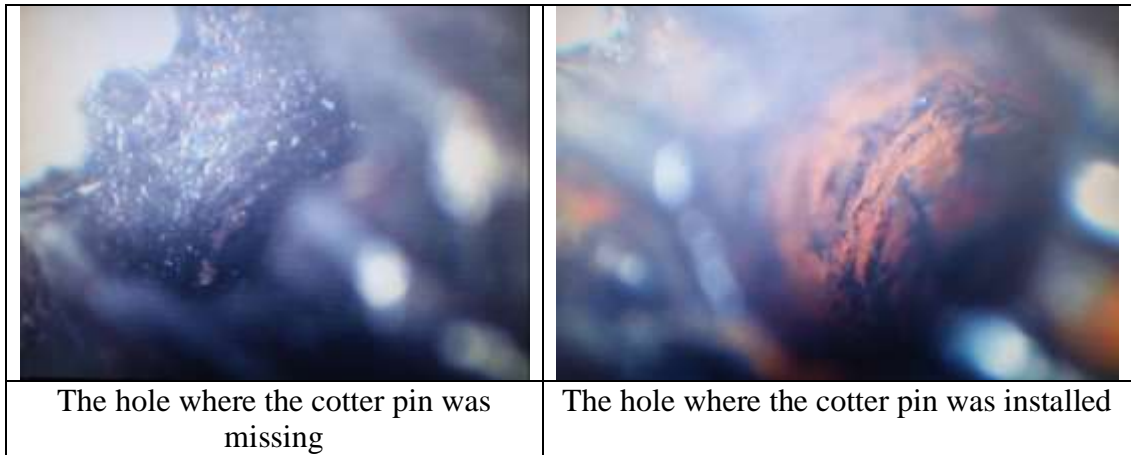


Figure 9: Comparison of the cotter pin hole of the axle stud

The cotter pin hole of the axle stud where the nut and its cotter pin were installed exhibit corrosion, indicated by the rust inside of the hole. The rust most likely generated during the operational where the surface of the inner surface of the hole was in contact with the cotter pin while the grease or other lubricative material was not present.

The application of cotter pin for securing the castellated nut in the axle stud, required to be spreaded the cotter pin ends to keep the castellated nut in place. Removing castellated nut, requires removing the cotter pin from the cotter pin hole. If the cotter pin is not installed or detach following a deformation or broken on its spreaded ends.

The cotter pin was made of carbon steel or corrosion resistant steel, the cotter pin prone to be brittle or deformed in the size after the application for securing the castellated nut.

In summary, the examination showed that the cotter pin hole where the castellated nut was missing exhibit a dirt like grease residue and dust. The cotter pin trace in the cotter pin hole was difficult to be determined under the microscope. The condition of the cotter pin hole installed with the castellated nut and its cotter pin was similar to the cotter pin hole where the castellated nut and its cotter pin was missing. The exception was, a rust was developed inside the cotter pin hole where the castellated nut and its cotter pin was still in place.

1.7 Organizational and Management Information

The aircraft owned and operated by PT. Nusa Flying International which had a valid Pilot School Certificate (PSC) number 141/007.

The operator operated seven Cessna 172 aircraft and had just moved the training based from Budiarto Airport, Tangerang to Solo. The Nusa Flying International also had another training base in Ahmad Yani International Airport, Semarang.

1.8 Useful or Effective Investigation Techniques

The investigation was conducted in accordance with the KNKT approved policies and procedures, and in accordance with the standards and recommended practices of Annex 13 to the Chicago Convention.

2 ANALYSIS

During the fifth touch and go exercise, the pilots felt aircraft vibration as the nose wheel touched the runway. The flight instructor took over control and maintained the nose up attitude by increased engine power and slightly pulled the control column to minimize the weight on the nose wheel. The nose was lowered when the aircraft was about to stop. The nose wheel fork found scratch for about 5 centimeters, and the attachment hole for the nose wheel axle had eroded. Several parts of nose wheel assembly including the axle and axle nut detached and found near the area of the first touchdown.

The nose wheel attached to the fork by an axle which secured by castellated nut at each axle tip, and cotter pin to lock the castellated nut. The cotter pin prevents the castellated nut from loosening. Without the cotter pin, the castellated nut may rotate freely and loosening. The missing cotter pin may lead to loosening of the castellated nut and detached from the axle stud that led to the nose wheel detached from the nose landing gear fork.

The last maintenance on the nose wheel assembly was to repair on the shock strut and was performed 8 days prior to the occurrence flight. The detached of the nose wheel indicated that the castellated nut had been loosening and detached from the axle stud. The loosening castellated nut indicated that the cotter pin was not installed or eventually missing. Without cotter pin installed, the dirt might had accumulated in the cotter pin hole during the aircraft operation as found during the examination of the cotter pin hole under the microscope. The examination of the cotter pin hole under the microscope showed the similarity between the cotter pin holes where the castellated nut with the cotter pin in place and missing.

The missing of cotter pin might be due to it was not installed or reused a cotter pin. Reused the cotter pin, eventually would fracture and missing from the cotter pin hole, led to ineffective of securing the castellated nut. The investigation could not determine whether the cotter pin was not installed or missing after the repair.

The detachment of the nose landing wheel axle, axle nut and castellated nut, indicated that the cotter pin was not installed or missing. Without the cotter pin, the castellated nut would have been loosening and eventually detached.

3 CONCLUSION

3.1 Findings⁵

Findings are statements of all significant conditions, events or circumstances in the accident sequence. The findings are significant steps in the accident sequence, but they are not always causal, or indicate deficiencies. Some findings point out the conditions that pre-existed the accident sequence, but they are usually essential to the understanding of the occurrence, usually in chronological order.

According to factual information during the investigation, the Komite Nasional Keselamatan Transportasi (KNKT) identified the findings as follows:

- The pilots held valid licenses and medical certificates.
- The aircraft had valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R).
- The weather reported at the time of occurrence was clear, the wind was calm and the visibility was 6 to 7 kilometers.
- On fifth touch and go exercise, the aircraft vibrated after the nose wheel touched down. The flight instructor took over the control, then maintained the nose up attitude to reduce the load on the nose wheel.
- The nose wheel and several parts had detached near the area of the touchdown and supported by witnesses who saw the aircraft rolled without nose wheel at high attitude nose.
- When approaching taxiway C, the pilot lowered the nose and stopped the aircraft.
- No one injured as a result of this occurrence and the aircraft had minor damage.
- On 8 November 2016, the nose wheel was repaired as hydraulic leak was reported. on the next day. The reparation included the removal and reinstallation of the nose wheel. It was most likely that the cotter pin was not installed after this repair and the nut became loosening during the aircraft operation and detached on the occurrence flight.
- The detachment of the nose landing wheel axle, axle nut and castellated nut, indicated that the cotter pin was not installed or missing. Without the cotter pin, the castellated nut would have been loosening and eventually detached.
- The missing of cotter pin might due to it was not installed or reused a cotter pin. Reused the cotter pin in the axle stud, eventually would fracture and missing from the cotter pin hole, led to ineffective of securing the castellated nut.

⁵ Findings are statements of all significant conditions, events or circumstances in the accident sequence. The findings are significant steps in the accident sequence, but they are not always causal, or indicate deficiencies. Some findings point out the conditions that pre-existed the accident sequence, but they are usually essential to the understanding of the occurrence, usually in chronological order.

3.2 Contributing factors

The missing of cotter pin led to the loosening of the castellated nut. The loose castellated nut finally became detached from the axle stud that led the nose wheel detached from the nose landing gear fork.

4 SAFETY ACTION

The operator conducted corrective actions to respond the KNKT proposed safety recommendation written in the draft final report by issued Quality Assurance Notice number NFI-141/001/III/TEK/QC/2021 on 25 March 2021 for the technical division personnel to emphasize:

1. During Pre-flight inspection the engineer should ensure the installation of the aircraft component including nose landing gear bolt and castle nut is installed with cotter pin.
2. During maintenance or replacement of the nose landing gear, the engineer should install with the new cotter pin and prohibited the re-use of the cotter pin.
3. The engineer should record in the Maintenance Log Book of any replacement of the cotter pin and report to the Storeman.

5 SAFETY RECOMMENDATIONS

The KNKT acknowledges the safety actions taken by the operator, KNKT considered that the safety actions were relevant to improve safety and encourage the implementation of the safety actions.

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