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Visual Inspection of Mechanical Damage on Cessna 172 External Components at an Aviation Vocational School Hangar

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Abstract

Aircraft airworthiness and safety depend heavily on regular inspections to identify mechanical damage that may affect structural integrity and operational performance. This study aimed to identify, classify, and evaluate mechanical damage on the external components of a Cessna 172 aircraft (PK-AFB) located at the Aceh Aviation Vocational School Hangar. A qualitative descriptive research method was employed using a visual inspection approach based on the aircraft maintenance manual and inspection checklist. The inspection covered major external components, including the fuselage, wings, empennage, landing gear, and propeller. Data were collected through direct observation and photographic documentation, and the identified defects were categorized into good, minor, moderate, and severe damage levels. The results revealed various forms of mechanical deterioration, including corrosion, cracks, dents, deformation, loose fasteners, abrasion, and component degradation. Most fuselage, wing, and propeller components were classified as good to minor damage. However, severe damage was identified in several critical components, particularly the horizontal stabilizers, drain valves, shock absorber system, axle and bearing assemblies, brake system components, and tires. Corrosion was the most frequently observed defect across the aircraft. The study demonstrates that visual inspection is an effective method for assessing visible mechanical damage and determining the general condition of aircraft structures. The findings provide valuable information for maintenance planning, airworthiness evaluation, and aviation maintenance training activities.

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1. Introduction

Airworthiness and flight safety remain the primary concerns in aviation operations, requiring every aircraft to undergo regular inspections and maintenance in accordance with regulatory standards and manufacturer guidelines. Among training aircraft, the Cessna 172 is one of the most widely used platforms due to its reliability, ease of maintenance, and stable flight characteristics. Previous studies have emphasized that effective aircraft maintenance significantly reduces operational failures and enhances flight safety by ensuring structural integrity and system reliability throughout the aircraft life cycle (Gratton, 2016; Jong et al., 2024; Rosdi et al., 2025). Visual inspection has long been recognized as the first line of defense in identifying external defects before flight operations, particularly for

training aircraft that experience frequent usage and environmental exposure (Geisbush & Ariaratnam, 2023; Muhibbuddin, Hamidi, et al., 2025; Rengasamy et al., 2018). Research conducted by aviation maintenance organizations has further demonstrated that routine external inspections substantially help prevent minor defects from developing into critical failures (Erdiwansyah, Mamat, Ghazali, Basrawi, et al., 2026; Lapesa Barrera, 2026; Ruskin et al., 2021). These findings highlight the importance of systematic inspection procedures in maintaining the airworthiness of training aircraft such as the Cessna 172.

External aircraft components, including the fuselage, wings, empennage, landing gear, and propeller, are continuously subjected to mechanical loads, environmental conditions, and operational stresses that may result in various forms of damage. Common mechanical defects include corrosion, cracks, dents, deformation, loose fasteners, and surface wear, all of which can adversely affect aircraft performance and safety if left undetected. (Fitriyana et al., 2025; Muhtadin et al., 2026; Talreja & Phan, 2019). According to previous investigations on general aviation aircraft structures, corrosion and fatigue cracking are among the most frequently encountered maintenance issues, particularly in aging aircraft operated in humid environments (Iqbal et al., 2026; Khalisha et al., 2025; Valiev et al., 2024). Studies by structural maintenance researchers have also shown that even minor surface damage can propagate into more severe structural defects if not identified and repaired early. (Baker, 2004; Erdiwansyah, Mamat, Syafrizal, et al., 2025). Therefore, regular inspection of external components is essential to ensure continued structural integrity and operational safety.

Visual inspection is considered the most fundamental and cost-effective maintenance technique in aviation because it allows technicians to rapidly detect visible signs of deterioration without requiring sophisticated equipment. Numerous studies have demonstrated the effectiveness of visual inspection in identifying corrosion, cracks, impact damage, and deformation on aircraft structures. (Dwivedi et al., 2018; Selvakumar et al., 2025). Although advanced Non-Destructive Testing (NDT) methods such as ultrasonic testing, eddy current testing, and radiographic inspection offer higher detection capabilities for hidden defects, visual inspection remains indispensable during routine maintenance and pre-flight checks due to its simplicity and practicality. (Charalampous et al., 2020; Erdiwansyah, Mamat, Rosdi, Rashid, Syahir, et al., 2026). Researchers have further reported that the success of visual inspection largely depends on the competence, experience, and observational skills of maintenance personnel. (Erdiwansyah, Mamat, Ghazali, Syahir, et al., 2026; Timjerdine, 2023). Consequently, systematic visual assessment procedures, supported by manufacturer maintenance manuals, are essential for improving inspection accuracy and consistency.

In educational aviation environments, aircraft are frequently utilized as learning media to provide students with practical exposure to aircraft systems, maintenance procedures, and inspection techniques. The Cessna 172 aircraft located at the Aviation Vocational School Hangar in Aceh serves not only as an instructional platform but also as an asset for hands-on maintenance training. Previous studies on aviation education have highlighted the importance of using real aircraft as practical training tools to enhance student competence in maintenance and inspection activities. (Erdiwansyah, Mamat, Ghazali, et al., 2025; Mendes et al., 2022). However, aircraft used for educational purposes may experience prolonged exposure to environmental factors and repeated handling by trainees, increasing the likelihood of minor mechanical damage to external structures. (Mamat et al., 2025; Sun & Adnan, 2021). Therefore, continuous monitoring and assessment of aircraft condition are required to maintain safety standards and ensure the effectiveness of the learning process.

Several researchers have investigated aircraft damage assessment through visual inspection methods. Studies conducted on training and general aviation aircraft have identified defects such as skin corrosion, loose rivets, structural dents, and deformations resulting from operational and environmental factors (Das et al., 2021; Erdiwansyah, Mamat, Rosdi, Ghazali, Rashid, et al., 2026). Other studies have reported that the systematic classification of damage severity into minor, moderate, and severe categories helps maintenance personnel determine appropriate corrective actions and maintenance priorities (Erdiwansyah, Mamat, Basrawi, et al., 2025; Schijve, 2001). Furthermore, research on aircraft maintenance management emphasized that early detection of external damage significantly reduces maintenance costs and prevents unscheduled downtime (Muhibbuddin, Erdiwansyah, et al., 2025; Ren, 2021). Despite these findings, studies specifically focusing on the visual inspection of mechanical

damage to externally exposed components of Cessna 172 aircraft in vocational education settings remain limited, particularly in Indonesia.

Based on the background, this study aims to identify and analyze mechanical damage on the external components of a Cessna 172 aircraft at the Aviation Vocational School Hangar in Aceh through a systematic visual inspection. The investigation focuses on major external structures, including the fuselage, wings, empennage, landing gear, and propeller, while classifying observed damage into light, moderate, and severe categories. The results are expected to provide a comprehensive overview of the aircraft's condition, support maintenance decision-making, and contribute to improving aviation maintenance education and practical training.

The novelty of this research lies in its integration of visual inspection practices into aircraft maintenance education through the evaluation of real mechanical damage on a Cessna 172 aircraft used as a teaching platform at a vocational aviation school. Unlike previous studies that primarily focused on commercial aviation maintenance environments or advanced NDT techniques, this study provides a systematic assessment of external mechanical damage using only visual inspection methods based on manufacturer maintenance standards. Furthermore, the research introduces a structured damage classification framework for educational aircraft, enabling the identification, categorization, and documentation of defects commonly encountered in training environments. The findings are expected to establish a practical reference model for aircraft maintenance training institutions, particularly vocational schools, while simultaneously supporting aircraft airworthiness monitoring and maintenance planning in educational hangars.

2. Methodology

Fig. 1 illustrates the research methodology employed in this study to investigate mechanical damage to the external components of a Cessna 172 aircraft through visual inspection techniques. The study began with a comprehensive literature review and research preparation stage, aimed at understanding aircraft maintenance standards, visual inspection procedures, and common forms of mechanical damage found in general aviation aircraft. Information from previous studies and aircraft maintenance manuals served as the basis for developing the inspection framework.

The next stage involved preparing research instruments and supporting equipment. The materials and equipment used in this study consisted of the Cessna 172 aircraft (registration PK-AFB) as the research object; a visual inspection checklist; the Cessna 172 maintenance manual; a digital camera or smartphone for documentation; an inspection flashlight; stationery; and observation sheets. These tools were selected to facilitate non-destructive inspection and systematic data collection. Following the preparation stage, a visual inspection was conducted on all major external aircraft components, including the fuselage, wings, empennage, landing gear, and propeller. The inspection was conducted directly in the hangar by observing the physical condition of each component against the criteria specified in the aircraft maintenance manual. Attention was given to identifying visible signs of mechanical deterioration.

The data collection stage consisted of direct observation and photographic documentation. All detected defects and abnormalities were recorded using the inspection checklist, while photographs were taken to provide supporting evidence and facilitate subsequent analysis. This documentation process ensured that all observations could be systematically verified and reviewed. After data collection, the observed defects were classified by type, including cracks, corrosion, dents, deformation, loose rivets, and other visible mechanical damage. The classification process enabled a more structured evaluation of the aircraft's condition and helped determine the severity level of each defect.

Finally, the collected data were analyzed using a qualitative descriptive approach. The analysis focused on describing the condition of each aircraft component, identifying the extent of mechanical damage, and assessing its potential impact on airworthiness. Based on the analysis results, conclusions and recommendations were formulated regarding the aircraft's overall condition and the required maintenance actions. This methodological framework provides a systematic approach for evaluating

aircraft external structures while supporting maintenance education and training activities in vocational aviation institutions.

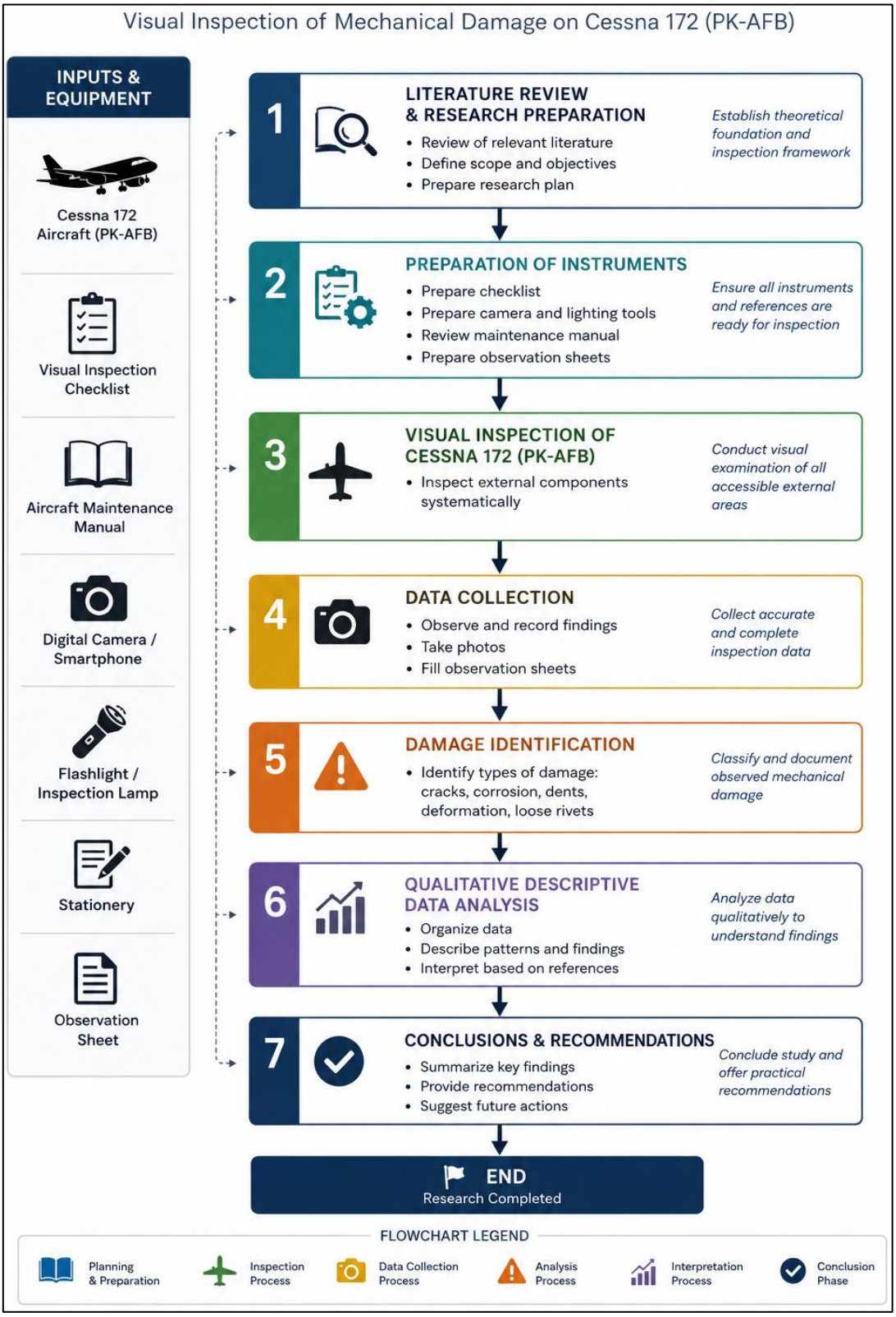

Fig. 1. Research Methodology Flowchart for Visual Inspection of Mechanical Damage on Cessna 172 External Components

3. Result & Discussion

This section presents the findings obtained from the visual inspection conducted on the external components of the Cessna 172 aircraft (PK-AFB) located at the Aceh Aviation Vocational School Hangar. The inspection focused on the major structural and functional components of the aircraft, including the fuselage, right and left wings, empennage, nose landing gear, right and left main landing gear, and propeller. The assessment was performed systematically, using a visual inspection checklist and guided by the aircraft maintenance manual, to identify visible signs of mechanical damage, including cracks, corrosion, dents, deformation, loose fasteners, and component deterioration. The collected data were subsequently classified into four condition categories: good, minor, moderate, and severe, to facilitate evaluation of the aircraft's overall condition. The discussion presented in this section analyzes the observed defects, their potential impact on aircraft safety and maintenance requirements, and their implications for aviation maintenance training activities within the vocational school environment.

Fig. 2. Cessna 172 Aircraft Located at the Aceh Aviation Vocational School Hangar

Fig. 2 shows the Cessna 172 aircraft (registration PK-AFB) located inside the Aceh Aviation Vocational School Hangar. The aircraft serves as the primary research object in this study and functions as a practical training platform for students studying aircraft maintenance and inspection procedures. As one of the most widely used single-engine training aircraft worldwide, the Cessna 172 is recognized for its simple structural design, ease of maintenance, and high operational reliability. The hangar environment provides a controlled setting for conducting systematic visual inspections, allowing researchers to access and examine all major external components of the aircraft, including the fuselage, wings, empennage, landing gear, and propeller. The availability of an actual aircraft in an educational institution offers valuable opportunities for students and researchers to apply maintenance knowledge in a realistic aviation environment.

The aircraft shown in **Fig. 2** was used to assess the condition of its external components through visual inspection. During the inspection, researchers carefully examined each accessible component for visible signs of mechanical damage, including corrosion, cracks, dents, deformation, loose fasteners, and surface wear. The observations obtained from this aircraft served as the primary data source for evaluating the overall condition and airworthiness of the aircraft structure. Furthermore, the findings provide useful information for maintenance planning and help improve practical learning activities in aircraft maintenance education. Therefore, the Cessna 172 aircraft shown in **Fig. 2** plays a crucial role not only as the object of investigation but also as an educational asset that supports the development of technical competencies in aviation maintenance and inspection.

Fig. 3 illustrates the visual inspection procedure applied to the Cessna 172 aircraft during the research. The inspection route follows a systematic sequence around the aircraft to ensure that all external components are examined comprehensively and that no critical areas are overlooked. The procedure begins at the fuselage section (Point 1), then proceeds to the empennage or tail assembly (Point 2), and finally to the right-wing area (Point 3). The inspection subsequently moves toward the wing root and upper fuselage sections (Points 4 and 5), where the condition of the wing-fuselage connections and upper structural surfaces can be assessed. The process then proceeds to the left-wing root and wing area (Points 6 and 7), before completing the inspection cycle by returning along the left wing toward the starting position (Point 8). This structured inspection path is consistent with standard pre-flight and maintenance inspection practices used in general aviation aircraft.

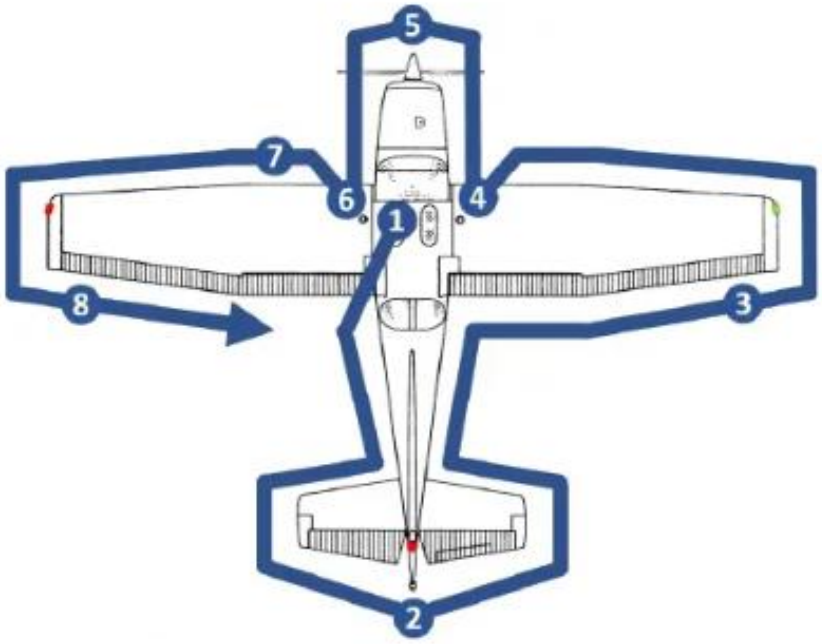

Fig. 3. Visual Inspection Procedure for the Cessna 172 Aircraft

The visual inspection procedure shown in **Fig. 3** provides a systematic framework for identifying mechanical damage on the aircraft's external components. By following a predefined inspection sequence, researchers can thoroughly evaluate critical areas such as the fuselage skin, rivets, wing structures, control surfaces, landing gear, empennage, and propeller for signs of corrosion, cracks, dents, deformation, loose fasteners, or other visible defects. The method minimizes the risk of missing inspection points and improves the consistency and reliability of observations. Furthermore, the use of a standardized inspection route facilitates documentation and comparison of findings between different aircraft sections. In this study, the procedure enabled the identification of various levels of mechanical damage across several components of the Cessna 172, providing essential information for assessing aircraft condition, determining maintenance priorities, and supporting aviation maintenance training activities at the Aceh Aviation Vocational School Hangar.

Table 1. Fuselage Inspection Results

Sub-Component	Observation Results	Category
Skin	Minor deformation and dents were observed	Minor
Rivet	20 rivets do not meet the required standard	Minor
Cowling	Three Camloc fasteners were detached	Moderate
Static Port	Slightly dusty, condition remains normal	Minor
Window	Normal condition	Good
Door	Corrosion observed on the keyhole area	Minor
Windshield	Slightly opaque/cloudy surface	Minor

Table 1 presents the visual inspection results of the fuselage components of the Cessna 172 aircraft. The findings indicate that most fuselage components were in generally acceptable condition, although several minor and moderate defects were identified. The aircraft skin exhibited minor deformation and small dents, which were classified as minor damage because they did not appear to compromise the fuselage's structural integrity significantly. Similarly, twenty rivets were found to be inconsistent with the required standard, suggesting possible deterioration or previous maintenance issues that require further attention. The cowling component exhibited a more significant defect: three Camloc fasteners were detached, resulting in a moderate damage classification. Detached fasteners can reduce the

security of the cowling assembly and may increase the risk of vibration or component displacement during aircraft operation. Meanwhile, the static port was slightly dusty but remained functional and was therefore categorized as minor damage.

The inspection also revealed several surface-related issues affecting other fuselage components. Corrosion was observed around the door keyhole, indicating exposure to moisture and other environmental conditions that may accelerate material degradation if left untreated. The windshield exhibited slight opacity or cloudiness, which may reduce visibility under certain lighting conditions and should be monitored during future maintenance activities. In contrast, the window component was found to be in good condition with no visible defects. Overall, the fuselage inspection results suggest that most identified defects are minor and primarily attributable to wear, environmental exposure, and component aging. However, the moderate damage observed on the cowling fasteners highlights the importance of regular inspections and timely corrective maintenance to ensure the aircraft's continued airworthiness, structural reliability, and operational safety.

Table 2. Visual Inspection Results of Right-Wing Components on the Cessna 172 Aircraft

Sub-Component	Observation Results	Category
Rivet	Normal condition	Good
Skin	Minor deformation observed	Minor
Wing Root	Deformation on the fairing	Moderate
	Two screws detached	Moderate
	Minor dent observed	Minor
	Three corroded screws	Minor
Wing Tip	Normal condition	Good
Fuel Cap	Normal condition	Good
Aileron	Normal condition	Good
Flap	Normal condition	Good
Drain Valve	Corroded	Severe
Strut Fairing	Cracked and broken	Moderate
	Five screws detached	Moderate
Pitot Tube	Normal condition	Good

Table 2 presents the visual inspection results of the right-wing components of the Cessna 172 aircraft. The inspection revealed that several components, including the rivets, wing tip, fuel cap, aileron, flap, and pitot tube, were in good condition with no visible signs of damage. However, minor defects were identified on the wing skin, where slight deformation was observed. The wing root area exhibited multiple issues, including fairing deformation and two detached screws, both of which were classified as moderate damage due to their potential impact on the aerodynamic smoothness and structural attachment of the component. In addition, a minor dent and three corroded screws were found in the wing root section, indicating the effects of prolonged exposure to environmental conditions and routine operational wear.

More significant damage was identified in other areas of the right-wing assembly. The drain valve was found to be severely corroded and therefore classified as severely damaged, as corrosion in this component may compromise fuel drainage and increase maintenance concerns. Furthermore, the strut fairing exhibited cracks and structural breakage, accompanied by five detached screws, resulting in a moderate damage classification. Damage to the strut fairing can degrade aerodynamic performance and allow moisture or contaminants to enter internal structural areas if not repaired promptly. Overall, the inspection results indicate that although most right-wing components remain in satisfactory condition, several defects associated with corrosion, loose fasteners, deformation, and structural deterioration require corrective maintenance. These findings emphasize the importance of regular visual inspections to maintain aircraft safety, structural integrity, and airworthiness.

Table 3. Visual Inspection Results of Left-Wing Components on the Cessna 172 Aircraft

Sub-Component	Observation Results	Category
Rivet	Normal condition	Good
Skin	Minor deformation observed	Minor
Wing Root	Deformation on the fairing	Moderate
	Two screws detached	Moderate
	Minor dent observed	Minor
	Twenty-three corroded screws	Minor
Wing Tip	Normal condition	Good
Fuel Cap	Six corroded screws	Minor
Aileron	Normal condition	Good
Flap	Normal condition	Good
Drain Valve	Corroded	Severe
Strut Fairing	Cracked and broken	Moderate
	One screw detached	Moderate
Pitot Tube	Normal condition	Good

Table 3 presents the visual inspection results of the left-wing components of the Cessna 172 aircraft. The inspection revealed that several components, including the rivets, wing tip, aileron, flap, and pitot tube, remained in good condition with no visible signs of damage. Minor damage was identified on the wing skin, where slight deformation was observed. More extensive findings were recorded in the wing root area, which exhibited fairing deformation and two detached screws, both classified as moderate damage due to their potential impact on structural attachment and aerodynamic performance. Additionally, a minor dent and twenty-three corroded screws were observed in the wing root section, indicating prolonged exposure to environmental conditions and possible deterioration of fastening elements. The fuel cap area also showed six corroded screws, which were categorized as minor damage but should be addressed to prevent further corrosion development.

More critical defects were identified in several structural components of the left-wing assembly. The drain valve was found to be corroded and was classified as severely damaged because corrosion may impair its operational function and compromise maintenance reliability. Furthermore, the strut fairing exhibited cracks and breakage, accompanied by one detached screw, resulting in a moderate damage classification. Structural deterioration of the fairing can reduce aerodynamic efficiency and may expose internal components to environmental contamination if left unrepaired. Overall, the left-wing inspection results indicate a damage pattern similar to that observed on the right wing, with corrosion, loose fasteners, and fairing deterioration representing the most common defects. These findings demonstrate the necessity of routine inspection and maintenance activities to prevent progressive damage, preserve structural integrity, and ensure the continued airworthiness of the aircraft.

Table 4. Visual Inspection Results of Empennage Components on the Cessna 172 Aircraft

Sub-Component	Observation Results	Category
Vertical Stabilizer	Normal condition	Good
Right Horizontal Stabilizer	Cracked and broken	Severe
Left Horizontal Stabilizer	Deformation on the fairing	Severe
	Cracked and broken	Severe
Rudder	The right cable cover is cracked and broken	Minor
Right Elevator	Normal condition	Good
Left Elevator	Normal condition	Good

Table 4 presents the results of the visual inspection of the empennage components of the Cessna 172. The inspection showed that the vertical stabilizer, right elevator, and left elevator were in good condition, with no visible signs of damage or structural deterioration. However, significant defects were identified in both horizontal stabilizers. The right horizontal stabilizer exhibited cracks and structural

breakage, which were classified as severe damage due to their potential impact on the aircraft's longitudinal stability and control performance. Similarly, the left horizontal stabilizer exhibited fairing deformation, cracks, and breakage, all categorized as severe damage. These findings indicate that the horizontal stabilizer assembly has experienced substantial deterioration and requires immediate maintenance attention to prevent further structural degradation.

In addition to the damage found on the stabilizers, the rudder component exhibited a cracked and broken right cable cover, which was classified as minor damage. Although this defect does not directly compromise the rudder's primary structural integrity, prolonged exposure may allow moisture, dust, or other contaminants to enter the control cable area, potentially accelerating component wear and corrosion. The concentration of severe damage within the horizontal stabilizer components suggests that the empennage has been exposed to environmental factors, aging, or mechanical stresses over an extended period. Since the empennage plays a critical role in maintaining aircraft stability and directional control during flight, defects in this area should be prioritized for corrective maintenance. Overall, the inspection results indicate that while several empennage components remain serviceable, the severe damage observed on the horizontal stabilizers represents a significant maintenance concern that must be addressed to preserve aircraft safety and airworthiness.

Table 5. Visual Inspection Results of Nose Landing Gear Components on the Cessna 172 Aircraft

Sub-Component	Observation Results	Category
Shock Absorber System	Hydraulic fluid leakage observed	Severe
Axle & Bearing	Corroded	Severe
Wheel Rim	Normal condition	Good
Tire	Cracked and deteriorated	Severe

Table 5 presents the visual inspection results for the nose landing gear components of the Cessna 172. The inspection revealed several significant defects affecting critical landing gear components. The shock absorber system exhibited hydraulic fluid leakage and was classified as severely damaged. Leakage from the shock absorber system can reduce its ability to absorb landing loads, potentially increasing stress on the landing gear structure during taxiing, take-offs, and landings. Similarly, the axle and bearing assembly showed visible corrosion and was categorized as severe damage. Corrosion in these components may accelerate wear, reduce mechanical reliability, and negatively affect wheel rotation and overall landing gear performance. In contrast, the wheel rim was found to be in good condition, with no visible signs of deformation, cracks, or corrosion.

The most critical finding was observed on the tire, which exhibited extensive cracking and material deterioration and was therefore classified as severe damage. Tire deterioration can significantly compromise operational safety by increasing the risk of tire failure during ground operations and landing. The combination of hydraulic leakage, bearing corrosion, and tire degradation indicates that the nose landing gear assembly has experienced substantial aging and environmental exposure. Since the nose landing gear is responsible for supporting aircraft maneuverability and stability during taxiing and landing, defects within this system require immediate corrective maintenance. Overall, the inspection results demonstrate that the nose landing gear is among the most severely affected areas of the aircraft, underscoring the importance of regular inspections and timely replacement of deteriorated components to maintain airworthiness and operational safety.

Table 6. Visual Inspection Results of Right Main Landing Gear Components on the Cessna 172 Aircraft

Sub-Component	Observation Results	Category
Fairing	Normal condition	Good
Right Strut	Normal condition	Good
Axle & Bearing	Corroded	Severe
Wheel Rim	Normal condition	Good
Brake System Components	Corroded	Severe
Tire	Cracked and deteriorated	Severe

Table 6 presents the visual inspection results for the right main landing gear components of the Cessna 172. The inspection revealed that several structural components, including the fairing, right strut, and wheel rim, were in good condition and showed no visible signs of damage or deterioration. These findings indicate that the primary structural support elements of the right landing gear remain serviceable and capable of performing their intended functions. However, significant defects were identified in other critical components. The axle and bearing assembly exhibited visible corrosion and was classified as severely damaged. Corrosion in these components may increase friction, accelerate wear, and reduce the reliability of wheel movement during ground operations. Similarly, the brake system components were found to be corroded and were also categorized as severely damaged, as corrosion may adversely affect braking efficiency and overall operational safety.

Another major concern identified during the inspection was the condition of the tire, which exhibited cracking and material deterioration and was therefore classified as severe damage. Tire degradation can compromise load-carrying capability, reduce traction, and increase the risk of failure during taxiing, take-off, or landing. The presence of severe damage in the axle and bearing assembly, brake system components, and tire suggests that the right main landing gear has experienced prolonged environmental exposure and aging-related deterioration. Since the landing gear system is essential for supporting aircraft weight and ensuring safe ground operations, these defects require immediate maintenance attention and possible component replacement. Overall, the inspection results indicate that although the structural framework of the right main landing gear remains in satisfactory condition, several operational components have deteriorated significantly and must be addressed to maintain aircraft airworthiness and operational safety.

Table 7. Visual Inspection Results of Left Main Landing Gear Components on the Cessna 172 Aircraft

Sub-Component	Observation Results	Category
Fairing	Normal condition	Good
Left Strut	Normal condition	Good
Axle & Bearing	Corroded	Severe
Wheel Rim	Normal condition	Good
Brake System Components	Corroded	Severe
Tire	Cracked and deteriorated	Severe

Table 7 presents the visual inspection results of the left main landing gear components of the Cessna 172 aircraft. The inspection showed that the fairing, left strut, and wheel rim were in good condition, with no visible signs of damage, deformation, or corrosion. These components remain structurally sound and continue to provide adequate support for the landing gear assembly. However, severe defects were identified in several critical operational components. The axle and bearing assembly exhibited significant corrosion and was therefore classified as severely damaged. Corrosion in these components may impair wheel rotation, increase friction during ground operations, and accelerate mechanical wear. Similarly, the brake system components were found to be corroded and categorized as severely damaged because deterioration of braking elements can reduce braking effectiveness and compromise operational safety during taxiing and landing.

The tire was also identified as a major area of concern, exhibiting extensive cracking and material deterioration, which resulted in a severe damage classification. Deteriorated tires can reduce traction, weaken load-bearing capability, and increase the likelihood of tire failure during aircraft operations. The occurrence of severe damage in the axle and bearing assembly, brake system components, and tire indicates that the left main landing gear has been significantly affected by aging, environmental exposure, and insufficient maintenance over time. Interestingly, the damage pattern observed on the left main landing gear is very similar to that on the right, suggesting a consistent level of deterioration across both sides of the landing gear system. Overall, the inspection results demonstrate that although the primary structural components remain in satisfactory condition, several critical operational components require immediate maintenance or replacement to ensure safe ground handling, reliable braking performance, and continued aircraft airworthiness.

Table 8. Visual Inspection Results of Propeller Components on the Cessna 172 Aircraft

Sub-Component	Observation Results	Category
Spinner	Nine corroded screws and one popped-out fastener were observed	Minor
Blade	Abrasion was observed along the leading edge	Moderate

Table 8 presents the visual inspection results of the propeller components of the Cessna 172 aircraft. The inspection identified defects on both the spinner and blade sections of the propeller assembly. The spinner exhibited nine corroded screws and one popped-out fastener, which were classified as minor damage. Although these defects do not immediately compromise the structural integrity of the propeller system, corrosion on fastening elements may progressively weaken their holding capability and increase the risk of loosening during aircraft operation. The presence of a popped-out fastener also indicates a localized attachment issue that should be corrected to maintain proper spinner alignment and prevent excessive vibration.

The propeller blade exhibited abrasion along the leading edge and was classified as moderate damage. Leading-edge abrasion is a common form of wear caused by prolonged exposure to airborne particles, dust, moisture, and small debris encountered during aircraft operations. If left untreated, this type of surface deterioration may gradually reduce the propeller's aerodynamic efficiency and accelerate material degradation. Compared with the landing gear and empennage components, the damage observed on the propeller was less severe; however, the propeller remains a critical component directly responsible for thrust generation and engine power conversion. Therefore, periodic inspection, cleaning, corrosion treatment, and repair of worn leading-edge surfaces are essential to ensure optimal propeller performance, minimize vibration, and maintain the aircraft's overall safety and airworthiness.

4. Conclusion

This study conducted a visual inspection of the external components of a Cessna 172 aircraft (PK-AFB) located at the Aceh Aviation Vocational School Hangar to identify and classify mechanical damage based on its severity. The inspection results revealed that the aircraft exhibited various forms of mechanical deterioration, including corrosion, cracks, deformation, dents, loose fasteners, abrasion, and component degradation. Most fuselage, wing, and propeller components were found to be in good to minor damage condition, while several components, particularly the horizontal stabilizers, landing gear assemblies, and drain valves, exhibited moderate to severe damage requiring corrective maintenance.

The most critical findings were observed in the empennage and landing gear systems, where severe damage was identified in the horizontal stabilizers, shock absorber system, axle and bearing assemblies, brake system components, and tires. Corrosion was the most frequently observed defect, followed by loose fasteners and structural deterioration of fairings and external fittings. These findings indicate that prolonged environmental exposure and aging have contributed significantly to the degradation of several aircraft components. Overall, the visual inspection method proved effective in identifying visible mechanical damage and assessing the aircraft's general condition. The results provide valuable information for maintenance planning, airworthiness evaluation, and the enhancement of practical aircraft maintenance training within vocational aviation education institutions.

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