

Assessment of Construction Quality through Drone Technology – Comparing Drone Based and Ground-Based Inspections

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Abstract: In the last few years, drone technology has emerged as a vital aspect of the construction industry in view of their effective and safe ability to access site-generated real-time site information. These Unmanned Aerial Vehicles, commonly known as drones, are being utilized in various activities such as site monitoring, tracking, safety surveillance, and inspection. Their ability to access hard-to-reach areas, which was earlier considered unsafe, makes them a more preferable tool. At construction site execution level, quality assessment is one of the most prominent areas to concentrate on because it impacts structures directly with implications for safety, durability, as well as satisfaction for clients. Under customary quality assessment methods, personnel concentrate on making manual observations during construction activity execution. These activities often prove to be lengthy and risky for personnel. The advent of drone construction tactics enables construction personnel to use drone cameras to observe site conditions. While there is an increase in the application of drones for monitoring and safety purposes, their effectiveness with respect to construction quality assessment is still evolving from traditional ground-based inspections. Clearly understanding which quality parameters can be reliably evaluated using drone-based inspection and which aspects need close human observation is essential for effective implementation. This study focuses on the evaluation of the role of drone technology in construction quality assessment by comparing drone-based inspections with conventional manual inspection practices.

Keywords: Drone technology, Construction industry, Quality assessment, Inspection, Safety surveillance, Manual observation.

1. Introduction

This research study is to evaluate construction quality using drone technology and compare its performance with conventional ground-based inspections. The study will focus on evaluating parameters such as inspection accuracy, defect detection capability, time efficiency, cost effectiveness, safety, data quality, and ease of monitoring. The project also seeks to identify the limitations and challenges associated with drone implementation in construction environments, including regulatory restrictions, environmental conditions, data processing requirements, and operational costs.

2. Lecture Review

Drone Technology in the Construction Industry Pravinbhai,

K. D., Patel, A. S., Solanki, J. V., & Patel, V. (2024): The paper that was published in August 2024 in the International Research Journal on Advanced Engineering Hub (IRJAEH) on the role of Drone (UAV) technologies in enhancing the construction industry performance. The authors look at several ways in which Drones can be used for a variety of purposes from site surveying, land mapping, and building progress to structural inspections, safety assessments, and resource management with increased accuracy, speed of data collection, and decreased workforce compared with traditional means. Further, the study indicates how Drones allow for better decision making via real-time visual data and improved documentation throughout the entire lifecycle of the project. Many challenges remain such as regulatory restrictions, operating costs, insufficient technical expertise, and data processing problems to be resolved, but after reviewing the current state of Drones and discussing future trends, the authors believe that Drones will play a key role in the enhancement of productivity, quality, and safety within the construction industry when used in combination with modern Digital Tools and appropriate Government Regulatory support.

Adoption of Drone Technology in Construction – A Study on Interaction Between Various Challenges Prajapati, H. N., Gupta, A. K., & Sharma, R. K. (2024): This paper published in the World Journal of Engineering, the author uses a structured analysis of many possible barriers that will likely affect drone usage in construction and has identified many of the significant barriers to drone usage; Examples of significant barriers include regulatory barriers, the high initial cost and operational cost of drones, lack of skilled users, data security concerns, technology limitations, and organizational resistance. While identifying these barriers, the author has also shown that many of the barriers interact and influence each other, thus acting together rather than independently. Additionally, the author has presented that the regulatory barrier(s) and organizational barrier(s) can be the main driving force(s) behind amplifying the other technical and financial barriers. The authors state that in order to successfully adapt drone technology, there must be a comprehensive strategic plan that incorporates the numerous barriers simultaneously, therefore providing the means to support the use of drone technology through supportive

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regulations, specific training for drone users, reducing costs for drones, and creating an organizationally supportive environment for using drones in conjunction with traditional Construction Project Management/Quality Assurance practices.

Adoption of Drone Technology in the Indian Construction Industry Sivaraman, P., Judson, L., & Paul, V. K. (2025): This paper explores the increasing adoption of drone (UAV) technology in the Indian construction sector since August 2025 for increased efficiency, safety, quality assurance and project monitoring. The primary uses for UAVs include site surveying and mapping, progress tracking, structural inspection, safety surveillance and as a means for documentation, however the authors emphasize that drones allow you to collect data much quicker, more accurately and, for a fraction of the cost than conventional methods. The authors conclude that while the level of drone adoption currently within the Indian construction sector is relatively low, there is great future potential for the widespread use of UAV's, especially if supported with the right governing policies, training programs and integrated digital solutions such as BIM, AI and GIS that can ultimately help deliver a heightened level of construction management and quality control.

Table 1
Severity by mean variation

Image No.	Severity
1	Low
2	High
3	Medium



Fig. 1. Drone image of slab surface used for ImageJ analysis

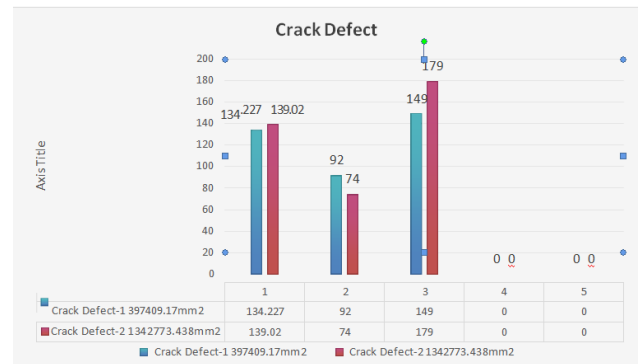


Fig. 2. Crack defect graph by ImageJ data

3. Conclusion

The study demonstrates that drone technology is highly effective for building quality assessment, particularly in detecting surface defects and evaluating workmanship with an accuracy rate of 95–97%. Drones enable faster inspections and reduce human error by providing comprehensive exterior views. However, their limitations lie in detecting internal cracks or defects due to restricted access and range of motion. Thus, while drones significantly enhance efficiency and safety in building inspections, they should complement rather than replace traditional manual methods for complete quality evaluation.

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