

FLOOD DISASTERS AND CONSTRUCTION PROJECT SCHEDULE PERFORMANCE IN TRADEMORE ESTATE, ABUJA, NIGERIA

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Abstract

Flooding poses a growing challenge to construction project delivery in rapidly urbanising areas of Nigeria. This study examined the reported effects of flood disasters on construction project schedule performance in Trademore Estate, Abuja. A quantitative cross-sectional survey design was adopted, where 280 respondents participated in the survey, comprising 210 residents and 70 construction professionals working within the estate. 210 questionnaires were distributed using a stratified random sampling technique, while 70 questionnaires employed purposive random sampling. The sample was purposively structured to obtain complementary perspectives from the two stakeholder groups and provide sufficient information for descriptive statistical analysis and thematic interpretation. Data were collected using a structured questionnaire and analysed primarily through descriptive statistics, including frequencies and percentages. The findings indicate that flooding disrupted construction activities across the major project phases, with superstructure construction recording the highest proportion of reported delays (37.5%), followed by foundation works (32.1%). Respondents also reported disruptions to site safety and emergency preparedness, including compromised compliance with safety regulations (50%), evacuation procedures (40%), emergency medical response (35%), PPE availability (30%), and safety training (25.7%). The reported project-phase durations also increased following flood events, particularly during superstructure and foundation activities. The study concludes that recurrent flooding represents an important project-management and occupational-safety concern in flood-prone urban developments. It recommends integrating flood-risk assessment, contingency scheduling, drainage improvement, early-warning systems, emergency preparedness, and climate-responsive construction planning into project management practices to improve project continuity and resilience in Abuja.

Keywords: Climate resilience, Construction projects; Flood disasters; Schedule performance, and Trademore Estate

INTRODUCTION

Flood disasters have become one of the most destructive natural hazards affecting urban environments, with their frequency and severity increasing under the combined influence of climate change, rapid urbanisation, land-use transformation, and inadequate drainage infrastructure (IPCC, 2023; UNDRR, 2024; Laidlaw & Percival, 2024; Wongnaa et al., 2024). Similarly, the United Nations Office for Disaster Risk Reduction (UNDRR, 2024) reported that floods remain the most frequently recorded natural disaster globally, causing widespread damage to infrastructure, economic losses, and disruptions to sustainable development efforts. Heavy precipitation events are becoming more frequent across many regions, increasing the exposure of urban settlements and infrastructure projects to flooding (Akanwa et al., 2026).

The construction industry is particularly vulnerable to flood hazards because successful project delivery depends on adherence to planned schedules, efficient resource utilisation, and uninterrupted site operations. Flood events disrupt construction through site inundation, damage to equipment and materials, restricted site access, workforce displacement, and interruptions to supply chains, often resulting in schedule overruns, cost escalation, contractual disputes, and reduced project performance. Studies emphasise that the increasing occurrence of climate-related disasters necessitates the integration of disaster risk reduction and resilience planning into construction project management to minimise project disruptions and enhance infrastructure resilience (Unegbu et al., 2024; Beitelmal et al., 2024). Further, this indicates that flood hazards increasingly threaten infrastructure systems and construction projects, particularly in rapidly urbanising regions where environmental planning has not kept pace with development (Ahmed et al., 2021).

In Africa, rapid urban growth has significantly increased flood vulnerability because infrastructure development has often outpaced environmental planning and stormwater management. Nigeria is among the countries most affected by recurrent flooding, with the 2022 floods demonstrating the devastating consequences of extreme hydrological events on infrastructure, housing, transportation networks, and economic activities. The United Nations Development Programme (UNDP, 2023) reported that the 2022 flood disaster caused extensive damage across several Nigerian states, highlighting the urgent need for more resilient infrastructure planning and flood risk management strategies.

Within the Federal Capital Territory (FCT), Abuja, Trademore Estate has emerged as one of the country's most flood-prone urban communities due to rapid residential expansion, encroachment on natural waterways, inadequate drainage infrastructure, and increasing impervious surfaces. Recurrent flood events have repeatedly disrupted ongoing construction projects, delayed housing delivery, increased rehabilitation costs, and undermined investor confidence. Despite these recurring challenges, empirical evidence examining how flood disasters influence construction project schedule performance in Trademore Estate remains limited. Most Nigerian studies have focused primarily on flood hazard mapping, vulnerability assessment, or disaster response, with comparatively little attention given to project schedule performance and construction management implications.

This study is underpinned by the Project Risk Management Framework (PRM), complemented by the Disaster Risk Reduction (DRR) Framework developed by the United Nations Office for Disaster Risk Reduction (UNDRR). The UNDRR advocates for disaster risk knowledge strengthening, disaster risk governance, and investing in resilience. Moreover, PRM emphasises the systematic identification, assessment, response planning, implementation, and monitoring of project risks throughout the project life cycle (Project Management Institute, 2021). These frameworks provide an appropriate lens for examining how flood disasters affect project schedule performance and for identifying strategies that strengthen project resilience in flood-prone urban environments.

Although previous studies have established that flooding adversely affects infrastructure and urban development, few have examined its specific influence on construction project schedule performance at the project level within rapidly urbanising Nigerian communities. Moreover, limited attention has been given to integrating disaster risk management principles with project scheduling to support climate-resilient construction practices. This study addresses these knowledge gaps by providing empirical evidence from Trademore Estate, thereby extending current understanding of how flood disasters influence project delivery within developing urban contexts.

The novelty of this study lies in its integration of disaster risk management, project schedule performance, and urban flood resilience within a single empirical framework. Unlike previous studies that predominantly examined flood impacts from hydrological or environmental perspectives, this research investigates flooding as a critical project management risk affecting construction scheduling and infrastructure delivery. The findings are expected to contribute to climate-resilient construction management by providing evidence-based recommendations for project managers, policymakers, urban planners, and disaster management agencies operating in flood-prone environments.

Accordingly, the study aims to examine reported flood-related disruptions to construction project schedule performance in Trademore Estate, Abuja, Nigeria. Specifically, the study seeks to: (i) identify the major flood-related factors reported to disrupt construction project schedules; (ii) assess the extent of reported schedule delays across different construction phases; and (iii) examine reported operational and safety disruptions associated with flooding during construction activities.

LITERATURE REVIEW

Flood Disasters and Construction Project Schedule Performance

Construction projects operate within dynamic environments where environmental hazards can significantly influence project performance. Among these hazards, flooding has become one of the most disruptive because it simultaneously affects construction activities, resource availability, logistics, workforce productivity, and stakeholder coordination. As climate change accelerates the frequency and intensity of extreme rainfall events, construction projects are increasingly exposed to schedule uncertainties that extend beyond conventional

project risks. Recent evidence indicates that climate-related disruptions are no longer isolated occurrences but recurring operational challenges requiring the integration of resilience into project planning and execution (Liyanage et al., 2024; De Iuliis et al., 2024).

Project schedule performance is widely recognised as a critical indicator of project success because it reflects the ability to complete planned activities within the stipulated timeframe while maintaining cost efficiency and quality standards. Delays in construction schedules often trigger cascading effects, including increased labour costs, extended equipment utilisation, contractual claims, inflationary pressures, and reduced client satisfaction. A systematic review of construction project performance in Nigeria identified inadequate risk management, ineffective planning, poor stakeholder coordination, and environmental uncertainties as major contributors to project delays, emphasising that environmental risks have become increasingly important in project management decisions.

Flood disasters influence project schedules through both direct and indirect pathways. Direct impacts include inundation of construction sites, damage to temporary works, equipment failure, erosion of foundations, and destruction of stored materials. Indirect impacts arise from disruptions to transportation networks, delayed procurement of construction materials, reduced labour availability, interruptions to utility services, and regulatory restrictions on site operations following flood events. These interconnected disruptions frequently affect critical project activities, extending project duration beyond planned completion dates. Recent reviews further suggest that the cumulative effects of repeated climate hazards often exceed the impacts of individual flood events because recovery periods overlap with ongoing construction activities, reducing overall project efficiency (Liyanage et al., 2024).

Growing attention has therefore shifted towards climate-resilient construction management. Unegbu et al. (2024) observed that the Nigerian construction industry is gradually incorporating adaptation measures such as climate-responsive design, sustainable construction materials, improved drainage systems, and enhanced project risk assessment into infrastructure planning. Nevertheless, implementation remains constrained by financial limitations, institutional weaknesses, fragmented regulatory frameworks, and inadequate technical capacity. Consequently, many infrastructure projects continue to rely on reactive rather than preventive flood management approaches, thereby increasing their vulnerability to schedule disruptions.

Beyond engineering considerations, contemporary studies increasingly recognise flood resilience as a multidisciplinary concept encompassing governance, policy implementation, stakeholder participation, and adaptive project management. Orimoogunje and Aniramu (2025), in their systematic review of flood resilience strategies in Lagos, argued that resilient infrastructure development requires integrating structural measures with land-use planning, early warning systems, institutional coordination, and community participation. Such integrated approaches reduce disaster-related interruptions while improving project continuity under changing climatic conditions. Their findings reinforce the argument that project schedule performance depends not only on engineering efficiency but also on the broader resilience of the urban system within which construction projects operate.

Similarly, recent reviews of green building and flood-resilient construction in Nigeria demonstrate that sustainable infrastructure practices, including permeable surfaces, green drainage systems, elevated building designs, and nature-based solutions, can substantially reduce flood-related project disruptions. However, adoption remains limited because of weak policy enforcement, insufficient investment, and inadequate integration of climate adaptation into conventional construction management practices. These limitations continue to expose urban construction projects to recurring schedule delays and increased lifecycle costs.

Although substantial progress has been made in understanding climate resilience within the construction sector, the existing literature remains dominated by systematic reviews, conceptual discussions, and broad national assessments. Empirical studies linking recurrent flood events directly to construction project schedule performance at the project level are comparatively scarce, particularly within rapidly urbanising Nigerian communities. Most previous investigations have concentrated on flood hazard assessment, infrastructure resilience, or disaster management, while relatively little attention has been devoted to quantifying how flood-induced disruptions affect construction scheduling, activity sequencing, resource allocation, and project delivery.

This gap is particularly evident in Trademore Estate, Abuja, where recurrent flooding has repeatedly disrupted residential development and infrastructure projects. Despite the area's increasing significance as a flood-prone urban settlement, limited empirical evidence exists on the relationship between flood disasters and project schedule performance. Addressing this gap will contribute to the growing body of knowledge on climate-resilient construction management by providing context-specific evidence to support adaptive project planning and flood risk management in Nigeria.

Project Risk Management Framework

This study is primarily anchored on the Project Risk Management Framework, which emphasises the systematic identification, assessment, response planning, implementation, and monitoring of project risks throughout the project life cycle (Project Management Institute, 2021). The framework recognises that effective risk management enhances project performance by reducing uncertainties that may adversely affect project objectives, including schedule, cost, quality, and scope. Within construction projects, environmental hazards such as flooding constitute external risks that require proactive identification and mitigation to minimise disruptions and improve schedule reliability. The framework therefore provides an appropriate theoretical basis for examining how flood disasters influence construction project schedule performance.

The PRM framework is complemented by the Disaster Risk Reduction (DRR) Framework developed by the United Nations Office for Disaster Risk Reduction (UNDRR), which advocates understanding disaster risk, strengthening disaster risk governance, investing in resilience, and enhancing preparedness for effective response and recovery (UNDRR, 2023). The DRR framework explains that disaster impacts are determined not only by the magnitude of hazards but also by the vulnerability and preparedness of exposed systems. Integrating the

PMBOK Project Risk Management Framework with the DRR Framework enables this study to examine flood disasters both as external environmental hazards and as project risks that can be anticipated, managed, and mitigated to improve construction project schedule performance.

Study Area

The study was conducted in Trademore Estate, a rapidly developing residential community located in the Lugbe District of the Federal Capital Territory (FCT), Abuja, Nigeria. It is situated in the Lugbe area, approximately at the coordinates 9.0000° N latitude and 7.4000° E SPlongitude as shown in Figure 1&2. The proximity of Trademore Estate to major routes like the airport road and its location near the Nnamdi Azikiwe International Airport make it an attractive location for residents and businesses, contributing to its rapid growth and development (Abuja Geographic Information System, 2022).

The estate's topography is a mixture of flat and slightly elevated areas, with some sections prone to flooding, especially in the lower-lying regions. The estate has experienced recurrent flood disasters over the past decade, largely attributed to intense rainfall, inadequate drainage infrastructure, rapid urban expansion, encroachment on natural floodplains, and poor land-use planning. These recurring flood events have resulted in substantial damage to residential properties, transportation infrastructure, and ongoing construction projects, making the area an appropriate case study for investigating the impacts of flooding on construction project schedule performance. The estate's total area of approximately 2.5 square kilometers encompasses both developed and undeveloped lands, some of which are yet to be fully serviced or protected from flood risks, thereby affecting construction schedules and project performance (Federal Capital Territory Administration, 2021).

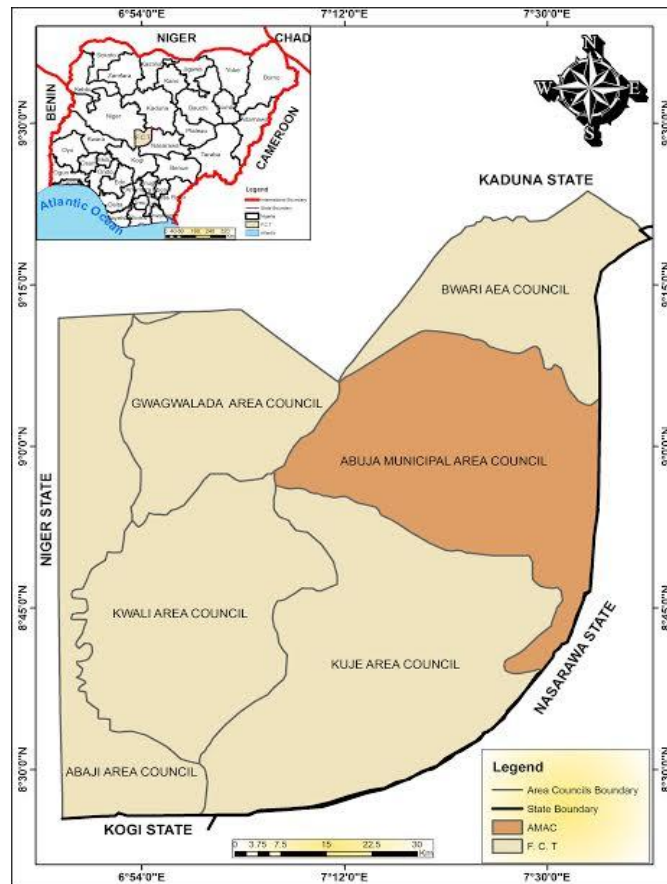


Figure 1: Federal Capital Territory (FCT)

Source: Compiled by Authors' (2025).

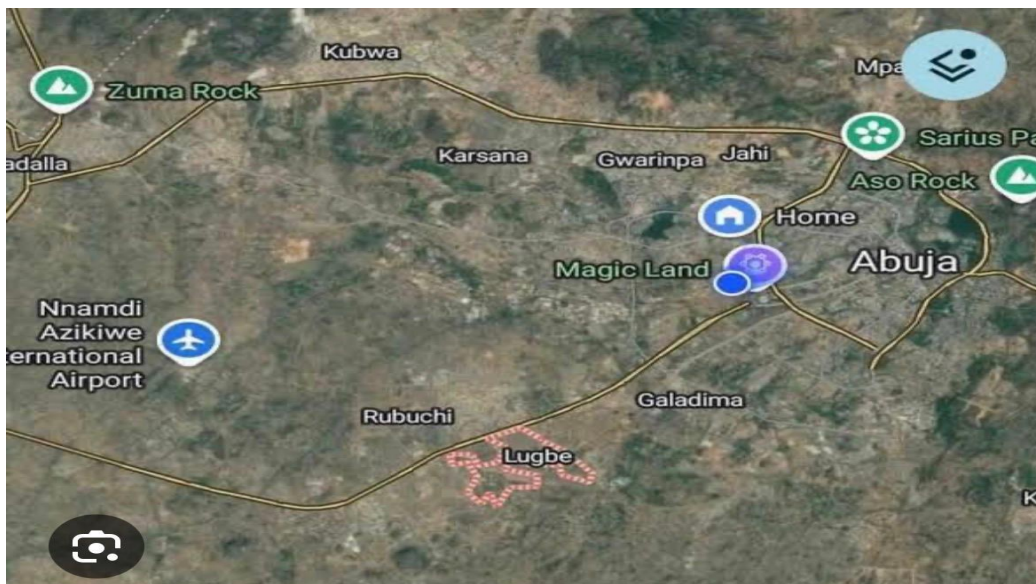


Figure 2: Showing Lugbe District, Abuja

Source: Compiled by Authors (2025).

MATERIALS AND METHODS

Research Design

The study adopted a quantitative cross-sectional survey design to obtain empirical information at a specific period. The design was appropriate for documenting respondents' experiences and perceptions concerning flood-related disruptions to construction activities, project schedules, and site operations. The analysis was descriptive and focused on identifying reported patterns of flood-related disruption using frequencies and percentages.

Population, Sampling and Data Collection

The target population for this study comprises the households residing within Trademore Estate, and construction professionals working on projects located in the Lugbe District of the Federal Capital Territory (FCT), Abuja, Nigeria. Because official census data at the estate level is unavailable, the sampling frame was established based on the estate's physical housing capacity. Trademore Estate consists of approximately 2,500 housing units spanning three development phases. Given that flooding is a spatial and structural phenomenon that impacts entire domestic units uniformly, households, rather than individual residents, were utilized as the primary sampling units (PSUs) to ensure analytical precision and geographic relevance.

To determine a scientifically representative sample size from the finite population of ($N = 2,500$) households, Yamane's formula was applied using a 5% margin of error. Based on the result, a sample size of 250 was obtained. Of the 250 deployed instruments, 210 questionnaires were fully completed, translating to an 84% response rate.

A total of 280 respondents participated in the survey, comprising 210 residents and 70 construction professionals. 210 questionnaires were distributed using a stratified random sampling technique, while 70 questionnaires were distributed using purposive random sampling. The sample was purposively structured to obtain complementary perspectives from the two stakeholder groups and provide sufficient information for descriptive statistical analysis and thematic interpretation. Purposive sampling ensured that respondents had relevant professional and lived experiences. Their involvement in construction activities provided the basis for obtaining information on flood-related disruptions to project schedules, construction phases, operational activities, and site safety. Primary data were collected using a structured questionnaire developed around flood occurrence, causes of flooding, construction delays, operational disruptions, and safety-related challenges. Responses to the relevant perception items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Data Analysis

The data were analysed using descriptive statistics, principally frequencies and percentages. The results were presented using tables and figures, with the findings interpreted in relation

to the study objectives and relevant literature. Consequently, the findings are interpreted as descriptive evidence of respondents' reported experiences

Ethical Considerations

Ethical approval for the study was obtained from the relevant institutional authorities before data collection commenced. Participation was voluntary, and respondents were informed of the purpose of the study before providing informed consent. Confidentiality and anonymity were maintained throughout the research process, and the information obtained from participants was used solely for academic purposes.

RESULTS

Reported Flood-Related Disruptions to Construction Project Schedules

Table 1 presents respondents' reported flood-related delays across the major construction phases in Trademore Estate. The pattern indicates that disruption varied across the project cycle, with the highest proportion of respondents reporting delays during superstructure construction and foundation work. During the superstructure phase, 105 respondents (37.5%) reported flood-related delays, with an average delay of 30 days. The reported duration for this phase increased from 250 days before flooding to 280 days after flooding, representing a 30-day increase in the reported phase duration.

Table 1: Perceived Effect of Flooding on Project Delay

Project Phase	Number of Respondents Reporting Delays	Average Delay Due to Flooding (Days)	Percentage of Respondents Affected (%)	Total Duration Before Flooding (Days)	Total Duration After Flooding (Days)
Planning and Permit	45	7	16.1	140	147
Site Preparation	70	15	25	150	165
Foundation Work	90	20	32.1	200	220
Superstructure Construction	105	30	37.5	250	280
Finishing and Inspection	55	10	19.6	100	106

Source: Compiled by Authors (2025)

Foundation work was the second most frequently reported area of disruption. Ninety respondents (32.1%) reported delays, with an average delay of 20 days. The reported duration increased from 200 to 220 days. Site preparation was affected for 70 respondents (25.0%), with an average reported delay of 15 days, while the reported duration increased from 150 to 165 days.

The planning and permit stage recorded the lowest proportion of reported disruption, with 45 respondents (16.1%) indicating delays averaging 7 days. The reported duration increased from 140 to 147 days. Finishing and inspection recorded 55 respondents (19.6%) reporting an average delay of 10 days, with the reported duration increasing from 100 to 106 days.

Notably, the descriptive pattern shows greater reported disruption during the physical construction stages than during planning and permitting. The results therefore suggest that activities requiring sustained site access, material movement, and continuous on-site work were more frequently reported as affected during flood events.

Reported Effects on Construction Safety and Compliance

Flooding was also reported to affect construction safety and operational preparedness. Fifty percent of respondents reported disruption to compliance with construction safety regulations, while 40% reported difficulties with site evacuation procedures. In addition, 35% reported delays in emergency medical response, 30% reported challenges associated with the availability or use of personal protective equipment (PPE), and 25.7% reported interruptions to safety training and awareness programmes.

Table 2: Perceived Effect of Flooding Safety Standard and Compliance

Safety Aspect	Number of Respondents Reporting Issues	Percentage of Respondents Affected (%)	Impact on Safety Compliance	Severity of Impact (Scale 1 – 5)
Use of Personal Protective Equipment (PPE)	84	30	Flooding led to limited availability or improper use of PPE, impacting worker safety	3
Site Evacuation Protocols	112	40	Flooding disrupted planned evacuation routes and protocols	4
Safety Training and Awareness	72	25.7	Flood-related disruptions reduced training sessions and awareness programs	2
Adherence to Construction Safety Regulations	140	50	Compliance with safety regulations was compromised due to site instability and equipment failures	4
Emergency Medical Response	98	35	Delays in emergency medical response due to flooding, leading to slower reaction times	3

Source: Compiled by authors (2025)

Collectively, these results indicate that respondents associated flood events not only with delays in construction activities but also with disruptions to safety procedures and emergency preparedness. These findings provide an additional dimension to the schedule-performance issue because interruptions to safety procedures, evacuation arrangements, and emergency response can affect the continuity of construction operations.

DISCUSSION

The findings from Trademore Estate indicate a clear pattern of reported flood-related disruption across the construction project cycle, although the extent of disruption varied by construction phase. Superstructure construction recorded the highest proportion of respondents reporting delays (37.5%), followed by foundation works (32.1%). This pattern is consistent with the broader construction literature showing that adverse weather can interrupt activities that depend on continuous outdoor work, site access, material movement and stable working conditions. A systematic review by Schuldt et al. (2021) identified precipitation, extreme temperatures and high winds among the weather conditions most frequently associated with construction disruption, while emphasising the implications for work feasibility, productivity and project duration.

The findings are also consistent with evidence from Nigeria, where construction project delays identified inclement or bad weather among the underlying factors associated with construction delay, alongside material supply and management-related factors (Unegbu, 2023, 2024; Egwim et al., 2023). Additionally, examining delay causes in Nigerian power construction projects demonstrated that construction delays arise from multiple interacting project and external factors (Laidlaw and Percival, 2024; Beitelmal et al., 2024; De Iuliis et al., 2024; Ismaila et al., 2022).

The relatively high disruption reported during foundation and superstructure activities is particularly important. Foundation construction requires stable ground conditions, excavation, access, and effective movement of equipment and materials. Superstructure activities likewise depend on continuous site operations and coordinated material and equipment flows. Several studies have indicated that precipitation was ranked as the most important weather factor affecting concrete construction productivity, although its effects varied according to the type of work and intensity of the weather event (Orimoogunje & Aniramu 2025, IPCC 2023, and PMI 2021; Rudberg 2023). This provides useful support for the Trademore finding that disruption is not uniform across construction phases.

The reported increase in the superstructure phase from 250 to 280 days and in the foundation phase from 200 to 220 days further illustrates the practical significance of weather-related disruption in the study area. However, these figures should be interpreted as reported changes in project-phase duration, rather than statistically demonstrated effects of flooding. This distinction is important because the present study relies on descriptive frequencies and reported delay durations rather than respondent-level inferential analysis. The evidence therefore establishes a pattern of perceived and reported disruption rather than a statistically tested causal relationship.

Recent climate-construction research reinforces this interpretation. Oruc et al. (2024) demonstrated that incorporating climate effects into construction scheduling can substantially alter estimated project durations. Their analysis showed that climate-related conditions can increase construction duration and associated costs when conventional schedules fail to account for changing environmental conditions. These findings suggest that construction programmes developed without adequate consideration of climate and weather variability may underestimate the time required to complete exposed activities.

The safety findings add another important dimension. Half of the respondents reported compromised compliance with construction safety regulations, while 40% reported disruption of evacuation procedures, 35% reported delays in emergency medical response, 30% reported PPE-related challenges, and 25.7% reported interruptions to safety training. These results are consistent with the wider literature showing that adverse weather affects not only construction productivity but also occupational health and safety. Karthick et al. (2023), for example, identified numerous health and safety challenges associated with extreme weather exposure among construction workers and emphasised the need for weather-sensitive work practices and protective measures.

Studies in Nigeria are particularly relevant, where Moda et al. (2024), studying 576 Nigerian construction workers, found substantial safety and productivity concerns associated with extreme weather conditions and highlighted the importance of early-warning systems, tailored adaptation measures, and improved worker awareness. Although their study focused primarily on extreme heat rather than flooding, the broader implication applies to Trademore: construction safety management needs to account for climate-related hazards rather than treating environmental conditions as separate from occupational risk.

The findings should also be considered within Nigeria's wider flood-risk context. Umar and Gray (2022) documented the recurrent occurrence and diverse impacts of flooding across Nigeria and highlighted the importance of improved flood modelling and understanding of flood processes. For construction projects, this broader flood-risk environment strengthens the case for integrating site-specific flood assessment, drainage planning, weather information and emergency preparedness into project management.

The evidence therefore supports a shift from reactive flood response to anticipatory construction-risk management. Project managers in flood-prone environments should incorporate seasonal rainfall information, flood-risk assessment, contingency time, alternative access arrangements, protection of construction materials and equipment, emergency evacuation procedures and flexible scheduling into project plans. Schuldt et al. (2021) similarly emphasised the importance of identifying weather-vulnerable activities and developing mitigation strategies that account for changing climatic conditions.

More recent evidence also suggests that the temporal dimension of construction vulnerability deserves greater attention. Nilsson et al. (2026), examining construction workers' experiences of extreme weather, found that adverse weather can disrupt established work rhythms and widen the gap between scheduled plans and the actual time required to complete construction

tasks. This is particularly relevant to our findings because the reported delays indicate that flood events may interfere with the sequence and continuity of scheduled activities.

Overall, this study contributes site-level descriptive evidence to the growing literature on climate-related construction risk. Its contribution lies less in establishing a statistically causal relationship and more in documenting how respondents experienced flood-related disruption across construction phases and safety functions. The findings support the argument that flood risk should be incorporated into construction scheduling, occupational safety planning, and urban development management. In flood-prone parts of Abuja, improving drainage and flood preparedness should therefore be considered not only an urban environmental priority but also a component of effective construction project management.

Policy Implications

The findings have important implications for flood-resilient construction planning in Trademore Estate and other flood-prone urban areas of Abuja. First, flood-risk assessment should be incorporated into the approval and planning stages of construction projects rather than treated solely as an emergency-management issue. Planning authorities should require developers to consider site drainage, flood exposure, access routes, and emergency-response arrangements before construction begins. Second, construction schedules should incorporate weather-sensitive planning and reasonable contingency periods, particularly for foundation and superstructure activities, which recorded the highest reported disruption in this study. Third, improved drainage infrastructure, regular maintenance of existing drainage channels, and enforcement against development within vulnerable drainage and flood pathways should be prioritised. Fourth, construction firms should strengthen site-level preparedness through early-warning systems, evacuation plans, emergency medical arrangements, appropriate PPE, and worker safety training. These measures align with the broader emphasis on resilience, climate adaptation and risk-informed infrastructure planning (Beitelmal et al., 2024; De Iuliis et al., 2024; Laidlaw & Percival, 2024; Orimoogunje & Aniramu, 2025). Policymakers should also encourage collaboration among developers, construction professionals, disaster-management agencies, and urban-planning authorities to improve flood preparedness and reduce avoidable project disruption.

CONCLUSION

This study examined reported flood-related disruptions to construction project schedule performance in Trademore Estate, Abuja. The findings show that flooding was associated with disruption across the major construction phases, with superstructure construction and foundation works recording the highest proportions of reported delays. Respondents also reported important effects on safety compliance, evacuation procedures, emergency medical response, PPE availability, and safety training. These findings indicate that flood risk represents a broader construction-management challenge extending beyond schedule delays to operational safety and emergency preparedness. The study therefore supports the

integration of flood-risk assessment, contingency scheduling, drainage planning, early-warning systems, and safety preparedness into construction management. For flood-prone urban developments in Abuja, strengthening the connection between disaster-risk management and construction planning is essential for improving project continuity and resilience. Overall, the study demonstrates the practical importance of treating recurrent flooding as a core project-management consideration rather than an external environmental issue.

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