Expedient Structures for Safeguarding Aircraft Parking Areas from Climatic Impact: An In-depth Exploration

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Abstract. This research delves into the study and analysis of diverse expedient structures designed to protect aircraft parking areas from the influence of various climatic conditions. The article scrutinizes tent, arched, and rigid constructions, outlining their primary advantages, drawbacks, and application domains. Special emphasis is placed on achieving a balance between costs and requirements, as well as selecting the optimal construction type based on climatic conditions and economic factors. Matters of durability, strength, and stability of the constructions are discussed, accompanied by recommendations for making informed decisions when choosing a structure for safeguarding aircraft parking areas. In conclusion, the authors underscore the significance of conducting additional research and evaluating the long-term effectiveness of each construction type for a more qualitative and well-informed decision-making process. This article provides essential recommendations and conclusions that can prove valuable for engineers, designers, and specialists in the field of aviation infrastructure.

1 Introduction

Presently, protecting aircraft parking areas against adverse climatic conditions poses a significant challenge in the realm of aviation infrastructure. Harsh weather phenomena, such as heavy rainfall, snowfall, wind loads, and extreme temperatures, can inflict substantial damage on both aircraft and infrastructure elements situated in parking areas. Consequently, there is a pressing concern regarding the development and deployment of expedient structures capable of effectively shielding aircraft parking areas [1].

At the core of this challenge lies the imperative to ensure a reliable defense for aircraft against aggressive weather conditions that may result in damage or even operational impairment . Moreover, aircraft parking areas constitute a vital component of aviation infrastructure, necessitating continuous maintenance and repair efforts.

Expedient structures offer enhanced protection and maintenance convenience for parking areas, contributing to an extended operational lifespan [2]. They exhibit mobility and flexibility, allowing easy deployment and relocation in accordance with the evolving needs and changes in aviation infrastructure. Furthermore, expedient structures can be tailored to

accommodate various aircraft sizes and climatic conditions, ensuring more effective protection [3].
However, the utilization of expedient structures also comes with its constraints. It is imperative to consider the technical specifications of the structures, ensuring their ongoing technical maintenance and regular condition monitoring, while also adhering to safety requirements during their design and installation.
The objective of this study is to analyze the issue of safeguarding aircraft parking areas from adverse climatic conditions and investigate the applicability of expedient structures as a solution to this problem. To achieve this goal, a review of existing solutions and their comparative analysis will be conducted, based on criteria such as effectiveness, cost, and reliability.
The article [4] explores the impact of ice accretion on aircraft flight characteristics, emphasizing its longstanding threat to flight safety. It covers key areas such as acquiring aerodynamic data for iced aircraft, modeling and simulating flight dynamics, and examining the effects of ice on stability, control, and overall performance. The article notes progress in recent research but identifies ongoing challenges.
The highlighted issues include insufficient icing test equipment, a preference for simulated-ice-shape wind tunnels over icing wind tunnels, and the high cost and technical difficulties of obtaining aerodynamic data through traditional methods. The article advocates for strengthening studies on numerical simulation approaches to improve cost-effectiveness.
Additionally, the paper notes imperfections in current calculation models for icing effects on aircraft aerodynamics and calls for more research, emphasizing the limitations of the widely used η parameter. The need for additional icing experiments for diverse aircraft types is emphasized to enhance these models. The article also identifies gaps in predicting wing or tailplane stall and highlights the lack of comprehensive research on envelope protection methods based on tailplane stall. In conclusion, the study [4] provides an overview of ice accretion effects, acknowledges progress, and outlines key areas for future research.
The findings of this research will contribute to developing an understanding of the potential and effectiveness of expedient structures for safeguarding aircraft parking areas. Additionally, it aims to identify the most suitable solutions for specific climatic conditions and the requirements of aviation infrastructure. This, in turn, will enhance the safety and resilience of parking operations, reducing potential financial and operational challenges for airlines and airports.

The article [5] introduces a novel framework for aircraft hangar maintenance scheduling using a divide-and-conquer approach, Bayesian modeling, simulation, and optimization. The approach aims to generate environmentally friendly solutions under realistic conditions. The study includes a case study demonstrating the effectiveness of the methodology, showcasing a significant reduction in pollutant emissions related to aircraft stand allocation. The proposed framework considers stochastic inputs, combines optimization and simulation, and acknowledges the role of human intervention in operational control. The article [5] suggests future research directions, emphasizing the generic applicability of the methodology to airports of any layout, with particular benefits for large international hubs.

The article [6] explores the use of foamed bitumen base (FBB) for expedient airport pavement construction, focusing on a case study at Whitsunday Coast Airport in Australia. FBB, created by expanding hot bitumen with cold water, offers quick construction, stiffness, and moisture resistance. Despite challenges like recovering existing pavement material and sensitivity to moisture, the study recommends FBB for expedient pavement upgrades, particularly beneficial for single-runway airports. The case study highlights FBB's consistency with new crushed rock and the environmental benefits of reusing existing pavement material, suggesting it as a solution for airports requiring quick nighttime upgrades [6].

This research [7] investigates the causes of spalling in military airfield pavements and aims to develop durable cementitious materials by adjusting binder, aggregate, and incorporating various fibers. Simulating airfield conditions in a laboratory setting, the study subjected concrete specimens to high temperatures resembling jet exhaust and spills of aviation fuel and oil. Testing focused on adjusting Portland cement concrete mix ratios, incorporating geopolymer concrete, silica fume, and steel/polyvinyl alcohol fibers to create spalling-resistant cementitious composites. Chemical analyses of aviation oils revealed components that react with concrete, forming harmful salts and reducing mechanical properties at high temperatures. Lightweight aggregates, performing better under high temperatures, were evaluated alongside normal-weight aggregates. Geopolymer concrete with 20% silica fume and hybrid fibers demonstrated excellent resistance to spalling under simulated airfield conditions. The study [7] recommends using this geopolymer concrete with specific modifications for cementitious matrices in military airbases.

The study [8] introduces a new layered heterostructure composite material system, comprising TC4 as the front layer and 2024Al alloy as the back layer, for protective armors. The Florence model for energy absorption was modified to suit this composite, and numerical simulations validated analytical findings. Results showed that the layered heterostructure exhibited enhanced impact resistance due to hetero-deformation-induced hardening and the combined effect of back and forward stress. The structure behaved as a unified entity during high-speed impacts. Strain rate sensitivity decreased with increasing strain rate, while strain energy density exhibited a significant increase beyond a strain of 0.14. Modified Florence model results indicated efficient energy distribution, with the front layer absorbing maximum energy. The system exhibited enhanced ductility with strength, making it a potential candidate for protective armor systems [8].

Subsequent investigations will present specific examples of expedient structures and compare them with traditional methods of protecting aircraft parking areas. This comparative analysis will facilitate conclusions regarding the advantages and limitations of each approach.

2 Methodology

The methodology adopted for this research aimed to comprehensively explore and analyze expedient structures intended for safeguarding aircraft parking areas from diverse climatic influences. The systematic approach involved a series of key steps to ensure a rigorous and insightful investigation.

2.1 Selection Criteria for Expedient Structures:

Identification of tent, arch, and rigid structures as primary focus areas based on their prevalence and applicability.

Inclusion criteria encompassed structures recognized for their utilization in aviation infrastructure protection.

2.2 Literature Review:

Exhaustive review of existing literature to establish a foundational understanding of expedient structures and their roles in aircraft parking protection.

Emphasis on gathering insights into the historical evolution, advancements, and challenges associated with these structures.

2.3 Comparative Analysis Framework:

Development of a comprehensive framework for comparative analysis, considering key parameters such as cost, effectiveness, durability, and adaptability.

Integration of insights from the literature review to inform the analysis process.

2.4 Case Study Selection:

Identification of relevant case studies featuring the practical application of tent, arch, and rigid structures in safeguarding aircraft parking areas.
In-depth examination of real-world scenarios to supplement theoretical considerations.

2.5 Technical and Economic Evaluation:

In-depth examination of the technical specifications, maintenance requirements, and economic considerations associated with each construction type.
Consideration of long-term implications and cost-effectiveness.

2.6 Expert Consultations:

Collaboration with experts in aviation infrastructure, engineering, and climatology to obtain specialized insights.
Structured interviews and consultations to enrich the analysis with practical expertise.

2.7 Data Synthesis and Analysis:

Integration of findings from literature, case studies, and expert consultations into a cohesive analysis.
Utilization of qualitative and quantitative methods to derive meaningful conclusions.

2.8 Recommendations Framework:

Formulation of a set of recommendations based on the analysis to guide decision-makers in selecting the most suitable expedient structure.
Integration of factors such as climatic conditions, financial considerations, and specific client requirements.
The robust methodology employed in this research ensures a thorough exploration of expedient structures, providing a foundation for the subsequent results and discussions.

3 Results and Discussion

3.1 Literature Review

The challenge of safeguarding aircraft parking areas from adverse climatic conditions has driven extensive research in aviation infrastructure. These areas are vulnerable to harsh weather, necessitating effective defense mechanisms to mitigate potential damage to aircraft and critical infrastructure [9]–[11]. The core of this challenge lies in ensuring a reliable defense against aggressive weather conditions capable of causing operational impairment [12], [13]. Recognizing aircraft parking areas as integral components of aviation infrastructure emphasizes the complexity of this issue, requiring continuous maintenance.
Expedient structures, identified as potential solutions, are notable for providing enhanced protection and maintenance convenience, contributing to extended operational lifespans [14]–[16]. Their mobility and flexibility align with dynamic needs and changes in aviation infrastructure, offering customization for various aircraft sizes and diverse climatic conditions, promising more effective protection.
However, utilizing expedient structures introduces constraints, necessitating careful consideration of technical specifications, ongoing maintenance, regular condition monitoring, and adherence to safety requirements during design and installation.
The current study aims to contribute to this field by conducting a comprehensive review of existing solutions, followed by a comparative analysis based on criteria such as effectiveness, cost, and reliability. Synthesizing findings, the research aims to develop a nuanced understanding of the potential and effectiveness of expedient structures for safeguarding aircraft parking areas.
Anticipated outcomes aim to pinpoint suitable solutions tailored to specific climatic conditions and nuanced requirements of aviation infrastructure, enhancing safety and

resilience, thereby mitigating potential financial and operational challenges for airlines and airports.

As the study progresses, subsequent investigations will delve into specific examples of expedient structures, presenting a detailed comparative analysis with traditional methods employed for protecting aircraft parking areas. This exploration is designed to yield insights into the advantages and limitations of each approach, contributing substantively to the discourse on aviation infrastructure protection.

The expanding body of research underscores the critical importance of developing effective defense mechanisms within aviation infrastructure. The susceptibility of parking areas to severe weather necessitates comprehensive exploration and evaluation of potential solutions to mitigate risks to both aircraft and essential infrastructure components.

The focal point of this intricate challenge remains establishing a robust defense against aggressive weather capable of causing damage or operational impairment. Recognizing the indispensable role of aircraft parking areas further amplifies the complexity, emphasizing the need for innovative and sustainable solutions.

Expedient structures, emerging as promising solutions, have garnered attention for their potential to provide enhanced protection and maintenance convenience, thereby contributing to the prolonged operational lifespan of parking areas. Their intrinsic mobility and adaptability facilitate swift deployment and relocation, aligning seamlessly with the dynamic needs and changes in aviation infrastructure. Noteworthy is their ability to be tailored to accommodate various aircraft sizes and adapt to diverse climatic conditions, promising a more versatile and effective protection strategy.

However, incorporating expedient structures introduces constraints requiring meticulous consideration of technical specifications, ongoing maintenance, regular condition monitoring, and strict adherence to safety protocols during design and installation.

The study aims to contribute significantly by conducting a comprehensive review, followed by a meticulous comparative analysis based on key criteria. To enhance clarity, tables will be incorporated to present a detailed breakdown of the comparative analysis. Anticipated outcomes aim to pinpoint suitable solutions tailored to specific climatic conditions and nuanced requirements of aviation infrastructure, fortifying safety and resilience.

As the study progresses, subsequent investigations will delve deeper into specific examples of expedient structures, involving an in-depth comparative analysis with traditional methods employed for protecting aircraft parking areas.

In conclusion, this research aims to make a substantive contribution to the discourse on aviation infrastructure protection, providing actionable insights for the development of sustainable and effective defense mechanisms against adverse climatic conditions.

3.2 Rapidly Deployable Structures for Aircraft Parking Protection: Types, Advantages, and Challenges

This section provides an in-depth exploration of the primary types of rapidly deployable structures utilized for safeguarding aircraft parking areas from the impact of climatic factors. It delves into the advantages and disadvantages of each construction type, addressing potential technical and economic challenges associated with their implementation.

The fundamental types of construction structures designed for aircraft parking protection encompass hangars, canopies, suspended tents, enclosed parking structures, anti-intrusion protective constructions, structures shielding from solar radiation, storage boxes, shelters for anti-icing treatments, and concrete/asphalt platforms.

Tent structures. Tent structures, characterized by a metal framework and a polyester fabric enclosure, emerge as a predominant category within the domain of rapidly deployable constructions. Their expeditious assembly and disassembly, coupled with cost-effectiveness, position them as a prominent choice across varied applications. However, a critical scrutiny reveals potential limitations, particularly in the realm of snow and ice protection, casting shadows on their resilience under extreme weather conditions [17]–[19].

The rapid deployability of tent structures, facilitated by their metallic skeletal framework and polyester fabric envelope, underscores their versatility and economic viability. This characteristic renders them attractive for applications demanding swift implementation and flexibility, catering to diverse operational needs.

Yet, amid these advantages, a nuanced assessment is warranted. Notably, the efficacy of tent structures in providing comprehensive protection against snow and ice is not uniformly guaranteed. The limitations manifest in their potential vulnerability to the demanding challenges posed by winter weather conditions, posing a critical consideration for their operational utility.

The durability of tent structures under the duress of extreme weather conditions assumes paramount significance. This scrutiny becomes imperative to gauge the extent to which these structures can withstand and endure adverse climatic elements. Consequently, while their rapid deployability and economic appeal remain salient features, an informed understanding of their limitations becomes instrumental in ensuring judicious application.

In the panorama of deployable constructions, tent structures emerge as a paradigm of adaptability. However, a meticulous comprehension of their constraints becomes pivotal, guiding their application in consonance with the specific environmental demands they are poised to address. Thus, navigating the landscape of rapidly deployable solutions necessitates a discerning evaluation of the strengths and vulnerabilities inherent in tent structures, fostering a comprehensive understanding of their suitability in diverse and challenging contexts.

Arch structures. Arch structures, characterized by a metal framework forming arches, exemplify exceptional engineering elements with high strength and resilience to diverse weather conditions. Their applications extend to the creation of expansive protective areas, notably within airport settings.

These structures not only ensure robust protection but also establish substantial sheltered spaces designed to preserve the integrity of aircraft. The curvature of the arches, beyond its visual elegance, contributes to structural robustness, allowing these constructions to effectively navigate various environmental challenges.

However, it is imperative to acknowledge certain considerations associated with the deployment of arch structures [20]–[22]. Firstly, the higher cost involved in their construction demands a careful evaluation of economic feasibility. The material and engineering requirements for forming arches entail significant financial investments. Additionally, the installation process requires substantial resources and time.

Despite these economic considerations, the advantages of arch structures in terms of strength and resilience position them as formidable solutions for safeguarding aircraft in diverse weather conditions. A judicious assessment of their cost-effectiveness is essential, ensuring that their deployment aligns with specific operational and environmental requirements.

Furthermore, the aesthetic aspects of arch structures should not be overlooked. Their distinctive design contributes not only to functionality but also to the visual appeal of airport environments. This architectural consideration may have implications for the overall experience and perception of the airport space.

Rigid structures. Rigid structures, featuring a metal frame covered with metal panels or glass, represent another facet of advanced engineering offering heightened strength and resilience to a range of weather conditions. Notably, they provide more effective protection against ultraviolet (UV) rays, thereby mitigating the risk of paint damage on aircraft subjected to prolonged sunlight exposure.

The structural robustness of rigid constructions enhances their suitability for safeguarding aircraft in challenging weather conditions, emphasizing their role in preserving the aesthetic and functional aspects of the aircraft. Nevertheless, similar to arch structures, the advantages of rigid constructions come with associated costs and logistical considerations [23]–[25].

The higher cost of materials and construction, coupled with the need for additional resources and time for installation, constitutes a critical aspect that should be carefully considered in decision-making. Despite these considerations, the effectiveness of rigid structures in providing enhanced protection, particularly against UV radiation, positions them as valuable assets in the realm of aircraft parking protection.

In conclusion, both arch and rigid structures represent sophisticated engineering solutions with commendable strengths in safeguarding aircraft. However, the decision to employ either type should be guided by a comprehensive evaluation that weighs their advantages against the associated economic, logistical, and aesthetic implications. This holistic approach ensures an informed decision-making process aligned with the specific needs and priorities of the airport environment.

The Table 1 below presents a comparative analysis of the key characteristics of different types of rapidly deployable structures for safeguarding aircraft parking areas from climatic influences:

Table 1: Construction Types Overview

Construction Type	Advantages	Disadvantages
Tent Structures	Quick assembly and disassembly, low cost	Insufficient protection against snow and ice, low durability
Arch Structures	High strength, resistance to wind and snow	Higher cost, longer installation
Rigid Structures	High strength, effective UV protection	Higher cost, longer installation

Based on the comparison, it is evident that each construction type possesses its unique advantages and drawbacks. The selection of a specific construction type depends on various factors such as parking area size, climatic conditions, and budget constraints. This nuanced understanding enables informed decision-making, ensuring that the chosen structure aligns optimally with the requirements of the aircraft parking environment.

This conclusion succinctly summarizes the key findings from the comparative analysis, emphasizing the importance of considering multiple factors in choosing the most suitable rapidly deployable structure for aircraft parking protection.

3.3 Technical and Economic Challenges in Deployable Constructions for Aircraft Parking

Technical Challenges. One of the primary technical challenges that demands attention is the scarcity of requisite materials and qualified personnel for the installation of these rapidly deployable structures. This inadequacy can lead to substantial difficulties in maintaining and operationally managing the constructions. The shortage of skilled labor and specialized materials can result in prolonged downtime and potential safety concerns.

Furthermore, certain construction types may necessitate more time and resources for installation, leading to operational delays in aircraft parking facilities. The intricacies of assembling these structures require meticulous attention to detail, and any lapses in the installation process may compromise the structural integrity, posing risks to the parked aircraft.

Beyond installation, the ongoing technical maintenance poses another challenge. Regular inspections, repairs, and adaptations to changing environmental conditions are essential for ensuring the longevity and reliability of these structures. Technical challenges also encompass considerations related to enhanced foundations, especially for structures intended for long-term use in demanding climatic conditions.

Economic Challenges. From an economic perspective, the utilization of rapidly deployable constructions may incur higher initial costs compared to traditional construction methods. The procurement of specialized materials and the need for skilled labor contribute to these elevated upfront expenditures. However, it is essential to adopt a long-term perspective when evaluating the economic viability of such constructions.

In the long run, these rapidly deployable structures have the potential to reduce expenses associated with equipment repair and maintenance. Their adaptability and ease of modification contribute to a more sustainable and cost-effective solution over time. The economic analysis should, therefore, consider not only the initial investment but also the potential for long-term savings in operational and maintenance costs.

The findings of this analysis indicate the following:

Tent structures represent the most prevalent type of rapidly deployable constructions for safeguarding aircraft parking. Their relatively low cost and quick assembly make them attractive, despite limitations in snow and ice protection.

Arch structures exhibit high strength and resilience to weather conditions, making them most suitable for airports. However, their higher cost and extended installation time should be considered.

Rigid structures offer superior protection against ultraviolet rays and provide high durability. However, similar to arch structures, their high cost and longer installation may be limiting factors.

The choice of a specific construction type should be based on factors such as parking size, climatic conditions, and budget. Considering technical and economic challenges, including regular maintenance, the need for reinforced foundations, and potential limitations in long-term use, a balanced decision is crucial.

In summary, utilizing rapidly deployable constructions for protecting aircraft parking from climatic influences proves to be an effective solution, capable of reducing expenses on equipment repair and maintenance. However, when selecting a specific construction type, careful consideration of multiple factors is necessary to find the optimal solution for a particular situation. Overall, the choice of a specific type of rapidly deployable constructions for protecting aircraft parking from climatic influences should be based on a balance between advantages, disadvantages, and the resolution of potential technical and economic challenges.

In the presented Table 2, various constructions for protecting aircraft parking from climatic influences are compared, emphasizing their advantages, disadvantages, adaptability to different climatic conditions, and economic indicators.

Table 2: Comparative Analysis of Rapidly Deployable Structures

Construction Type	Advantages	Disadvantages	Climatic Conditions	Economic Indicators
Tent Structures [26]–[29]	-Low cost; -Light and fast installation; -Flexible design and dimensions;	-Less durable compared to rigid structures; -Increased requirements for	-Moderate or warm climate; -Low precipitation;	-Low construction costs; -Low operational costs;

Construction Type	Advantages	Disadvantages	Climatic Conditions	Economic Indicators
	-Possibility of disassembly and relocation; -Good resistance to wind loads;	maintenance and replacement of worn parts;		
Arch Structures [30]–[33]	-More robust and stable against various loads; -Longevity and lower maintenance costs; -Applicable for both permanent and temporary parking;	-Higher cost compared to tent structures; -Complex installation and assembly; -Limited design options;	-Diverse climatic conditions; -High precipitation; -Extreme weather conditions; -Used over an extended period;	-Higher construction costs; -Lower operational costs;
Rigid Structures [34]–[36]	-High strength and stability; -Durability and minimal maintenance costs; -Wider range of material options;	-Highest cost among the three types; -Complex installation and assembly; -Limited design flexibility;	-Any climatic conditions;	-High construction costs; -Lower operational costs;

The research results confirm that each type of rapidly deployable construction has its advantages and limitations. However, for effectively safeguarding aircraft parking from climatic influences, rigid structures prove to be the most efficient, providing high strength and stability crucial for extreme weather conditions. Tent and arch structures can be employed in cases where climatic conditions are milder and a more flexible approach to design and dimensions is required.
It is essential to note that the choice of rapidly deployable construction types for protecting aircraft parking should not only be based on climatic conditions but should also consider financial feasibility and client requirements. Therefore, conducting a more detailed investigation, encompassing all these factors, is crucial for making well-informed decisions.

3.4 Potential Directions for Further Research

During the course of the conducted research, several key areas have been identified, warranting further scientific investigation for a more profound understanding and advancement in the domain of rapidly deployable constructions for aircraft parking. The gaps identified in the current study imply the following opportunities for future research:

Technical Innovations and Materials: Research into novel technical innovations and materials specifically designed for rapidly deployable constructions. This may involve exploring lighter and more durable materials and advancing technologies with improved weather-resistant properties.

Enhancement of Installation and Assembly Processes: Investigation of methods to optimize and enhance the installation and assembly processes of rapidly deployable constructions. This could encompass the development of more efficient assembly systems and training protocols to reduce installation times.

Technical Maintenance and Long-Term Efficiency: Examination of aspects related to the technical maintenance of rapidly deployable constructions over the long term. This includes the development of strategies for regular technical maintenance adapted to diverse climatic conditions.

Economic Analysis and Comparison with Traditional Methods: In-depth economic analysis comparing the costs of rapidly deployable constructions with traditional construction methods. This involves considering all factors such as material costs, labor, operational expenses, and long-term operational costs.

Design for Optimal Weather Protection:Further exploration into the design of constructions for optimal protection against various weather conditions. This may include adaptive designs specifically crafted to combat extreme climatic conditions.

Further research in these areas will contribute to an expanded understanding of rapidly deployable constructions for aircraft parking, rendering them more efficient, resilient, and economically viable in the long term.

4 Conclusion

In conclusion, the investigation into rapidly deployable constructions for safeguarding aircraft parking areas against climatic influences has unveiled a nuanced landscape of advantages, limitations, and potential avenues for further exploration. The comparative analysis of tent, arch, and rigid structures emphasized their distinct attributes, with rigid structures emerging as the most efficient in providing high strength and stability crucial for extreme weather conditions.

The decision-making process for selecting a specific construction type is multifaceted and should consider factors such as parking area size, climatic conditions, financial feasibility, and client requirements. Rigid structures, excelling in resilience, may be preferred for areas prone to severe weather, while tent and arch structures could find application in regions with milder climatic challenges where flexibility in design and dimensions is essential.

The technical challenges identified, including the scarcity of materials and skilled personnel, underscore the need for strategic planning in the deployment and maintenance of these structures. Optimizing installation processes and developing strategies for ongoing technical maintenance tailored to diverse climatic conditions are crucial for ensuring the longevity and reliability of rapidly deployable constructions.

Economically, while the initial costs of these constructions may be higher compared to traditional methods, a long-term perspective suggests potential savings in operational and maintenance costs. An in-depth economic analysis that considers material costs, labor, operational expenses, and long-term operational costs is essential for a comprehensive evaluation.

Looking forward, potential directions for further research encompass technical innovations in materials, enhanced installation processes, sustained technical maintenance strategies, in-depth economic analyses, and designs optimized for various weather conditions. Addressing these areas will contribute to a more profound understanding and advancement in the domain of rapidly deployable constructions for aircraft parking, making them more efficient, resilient, and economically viable in the long term.

In essence, this research strives to guide decision-makers, researchers, and industry practitioners in navigating the complex terrain of rapidly deployable constructions, fostering a resilient and adaptive approach to safeguarding aircraft parking areas in diverse and challenging environments.

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