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Spatial Requirements for Small Fixed-Wing and Rotary-Wing Aircraft Hangars: A Geometric and Optimization Approach

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Abstract: *Aircraft hangars are critical infrastructure in general aviation, providing secure environments for aircraft storage, ground handling, and basic maintenance. Despite the widespread use of small fixed-wing and rotary-wing aircraft, existing aviation regulations and engineering literature lack validated quantitative guidance for determining minimum and optimal hangar floor area requirements, particularly for mixed-fleet operations. This gap is especially evident in the Philippine context, where national aviation and building regulations address structural integrity, fire safety, and aerodrome standards but do not specify aircraft-specific interior spatial clearances.*

This study develops a quantitative, engineering-based framework for determining hangar floor area requirements for small fixed-wing and rotary-wing aircraft. Using geometric analysis, aircraft dimensional data, and safety clearance envelopes, mathematical formulas were derived to compute minimum floor areas for single and multiple aircraft configurations. Computer-aided design (CAD) simulations were applied to evaluate side-by-side, nose-to-tail, and staggered layouts while integrating personnel maintenance walk-around zones and National Building Code circulation requirements.

Results show that optimized layouts can reduce hangar floor area by 4–7% for fixed-wing aircraft using nose-to-tail arrangements and by 7–10% for rotary-wing aircraft using staggered configurations. Mixed-fleet optimization achieved approximately 10% space savings compared with heuristic designs while maintaining safety compliance. The proposed framework provides validated, adaptable design guidance for general aviation hangars, supporting safer, more efficient, and cost-effective facility planning in the Philippines and similar operational environments..

Keywords: Hangars, Floor areas, Safe, Operational Environment

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