An Integration Model for Low-altitude Economic Infrastructure and Building Management Aimed at Urban Renewal

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Abstract: With the development of the low-altitude economy, the demand for construction of low-altitude take-off and landing facilities, communication base stations, and intelligent machine nests has been increasing day by day. During the urban renewal process, integrating low-altitude economic infrastructure with building management organically is an important way to meet the construction needs of low-altitude economic infrastructure in cities. This paper analyzes the integration requirements of low-altitude economic infrastructure and building management, and proposes specific implementation suggestions, with the aim of providing references for promoting the deep integration of low-altitude economy and urban building management.

***Keywords*:** low-altitude economy; urban renewal; building management; integration model

1. Introduction

Low-altitude economy is a new comprehensive economic form centered on the low-altitude flight operations of various aircraft, integrating emerging technologies such as intelligent and digital technologies [1]. The state attaches great importance to the development of low-altitude economy. In 2024, low-altitude economy was first included in the government work report; in 2025, the "Opinions of the Central Committee of the Communist Party of China and the State Council on Promoting High-Quality Development of Cities" proposed to promote the development of low-altitude economy; low-altitude economy was also included in the "15th Five-Year Plan for Urban Renewal". However, the development of low-altitude economy requires low-altitude infrastructure as the material basis. At the same time, China's urban development has entered a transformation stage dominated by the renewal of existing assets, and a large number of existing buildings face the demands for functional improvement and space reuse. How to effectively integrate low-altitude economic infrastructure with building management to achieve space sharing, functional complementarity, and safe coordination has become a key issue that needs to be addressed to promote the coordinated development of urban renewal and low-altitude economy. This article explores the integration model of low-altitude economic infrastructure and building management for urban renewal, aiming to facilitate urban building renewal and the integrated development of low-altitude economy.

2. Urban building renewal demands for low-altitude economy development

2.1 Spatial supply demand

Low-altitude economy is centered on unmanned aircraft and other flying vehicles, and the take-off and landing facilities require sufficient site space to revitalize the existing building space. The layout of low-altitude take-off and landing facilities requires flat and open sites, far from obstacles, and must be equipped with operation management areas. However, urban populations are dense, and land resources have been occupied by existing public facilities, and the construction of new take-off and landing sites faces high land costs and space constraints. Revitalizing building space has become an important way for low-altitude infrastructure construction [2]. Existing building rooftops, corners, parking lots, etc. can be transformed through renovation and upgrading into take-off platforms and infrastructure layout.

2.2 Safety protection demand

Low-altitude aircraft take-off and landing fields need to meet strict floor load, clearance conditions, and electromagnetic compatibility requirements. Moreover, the external low-altitude infrastructure is exposed to the outdoors for a long time and must have the ability to resist wind, lightning strikes, and strong winds, and the electromagnetic signals generated by the operation of the flight equipment cannot interfere with low-altitude flight routes. Therefore, the construction of low-altitude economic infrastructure has higher requirements for building safety performance. During urban building renewal, buildings need to upgrade lightning protection and grounding, as well as wind-resistant and earthquake-resistant construction systems, and optimize the durability of exterior walls and roof insulation structures.

2.3 Functional integration demand

The continuous operation of low-altitude aircraft not only requires take-off and landing facilities but also relies on the coordinated support of communication navigation, meteorological monitoring, energy supply, and safety control facilities. If these facilities are independently occupied, it will further exacerbate the space shortage. This requires urban buildings to achieve functional integration during renewal. For example, the roof of the building can integrate communication relays, meteorological monitoring equipment, and charging facilities; the building facade can embed low-altitude sensing terminals; the interior of the building needs to reserve functional spaces such as flight control rooms and equipment machine rooms. Therefore, when developing low-altitude economy, the functional positioning of buildings should shift from a single residential/commercial function to a composite function of low-altitude economic services, achieving the integration of low-altitude economic infrastructure through space-intensive utilization.

3. Integration model of low-altitude economic infrastructure and building management for urban renewal

3.1 Promoting low-altitude functional integration transformation of building existing space

Newly added urban construction land is limited, and the location of low-altitude infrastructure needs to fully utilize the space resources of existing buildings. Through the functional integration transformation of existing building space, low-altitude infrastructure can be embedded in the urban renewal process and be included in the overall planning of building space. Unused spaces such as building rooftops, top of podium buildings, building facades, and underground spaces can all become the carrying spaces for low-altitude infrastructure. In the renovation of existing buildings, drone take-off and landing platforms or intelligent machine nests can be set up on the roof plan layout, vertical take-off and landing fields can be set up on the roof of the podium building, and low-altitude communication antennas and sensing equipment can be installed on the exterior walls of the building. Low-altitude communication relay modules and meteorological sensing terminals can be added to street lamp poles and surveillance poles. For new buildings, installation conditions for low-altitude infrastructure should be reserved during the design stage, including roof load reservation, power interface reservation, and communication pipeline pre-burial.

It is also necessary to solve the coordination problem between building functions and low-altitude functions. For example, the location of the take-off and landing platform should consider not only flight safety and airspace conditions but also the interference control on the internal use functions of the building to avoid noise, vibration, and privacy issues that affect the normal use of the building. During the building renovation process, structural safety should also be considered, and structural bearing capacity calculations and reinforcement designs should be carried out [3].

3.2 Promote the integration of building functions and low-altitude application scenarios

To match the functional configuration requirements of different low-altitude infrastructure, urban building renewal needs to be combined with the development direction of low-altitude industries in the area, carry out customized functional renovations, and achieve the deep integration of building space functions and low-altitude application scenarios. In response to the differentiated needs of mainstream businesses such as low-altitude logistics, urban inspection, and emergency rescue, the internal space movement lines and functional divisions of the building should be optimized and adjusted, and the connection paths between the roof take-off points and indoor storage spaces and passageways should be established, solving the problems of fragmented building space movement lines and inconvenient material transportation. In buildings with low-altitude logistics service demands, additional cargo storage areas, equipment storage areas, and dedicated channels for material connection should be added to adapt to the loading, transfer, and storage requirements of low-altitude logistics equipment. For emergency inspection low-altitude infrastructure, the operation space on the roof of the building should be optimized, and operation and emergency dispatching operation areas should be reserved.

In terms of logistics delivery, drones carrying parcels and food deliveries can land at designated receiving points in residential areas or office buildings, and the end delivery can be completed by property management or intelligent express delivery cabinets, avoiding the management troubles caused by frequent external personnel entry and exit. In terms of safety inspection, property management can use drones to conduct regular inspections of building exteriors, roof waterproof layers, and public areas of the building, replacing traditional manual climbing and ground patrols, improving inspection efficiency and reducing operational risks. In emergency response, drones can quickly ascend in case of emergencies such as fires or elevator entrapment, providing on-site images and auxiliary decision-making support.

3.3 Build a multi-party collaborative urban management mechanism

The management entities involved in the embedding of low-altitude infrastructure in building renewal expand from a single building owner or property management to low-altitude operation enterprises, airspace management departments, communication service providers, etc. Therefore, a multi-party collaborative governance mechanism needs to be established to clarify the boundaries of responsibilities and rights of each party to avoid management vacuum or functional overlap, ensuring that low-altitude flights comply with regulations and protecting the living rights of urban residents [4].

The relevant management departments need to formulate installation standards, operation norms, and safety management measures for low-altitude infrastructure in buildings, clearly defining facility ownership, operation authority, maintenance responsibility, and emergency response procedures. The building management party needs to revise property management systems and incorporate low-altitude infrastructure daily management into the existing management framework. At the regulatory level, the civil aviation management department, housing and urban management department, and urban management department need to establish coordination mechanisms, clearly dividing responsibilities for construction approval, operation supervision, and safety inspection of building-attached low-altitude infrastructure, forming a synergy. Through institutional guarantees, promote the collaborative operation of low-altitude infrastructure and building management from temporary cooperation to regular integration.

4. Conclusion

The integration of low-altitude economic infrastructure and building management is an inevitable trend for the coordinated development of urban renewal and emerging industries. This article, based on the construction needs of low-altitude economic infrastructure, analyzes the demand for building renovation and upgrading in the context of urban renewal, and explores the integration model from three dimensions: spatial integration, functional integration, and management integration. It proposes that in the process of urban renewal, the layout of low-altitude infrastructure and the utilization of existing building spaces should be coordinated, promoting the effective connection of low-altitude service functions and building operation management, and establishing a multi-party participation collaborative governance mechanism to open up new paths for the efficient utilization of urban space and the improvement of service quality.

References

[1] Su Yongying, Wei Dongping. Typical Correlation Analysis of Low-altitude Economic Development Driving Economic Growth in China [J]. Journal of Guangdong Light Industry Vocational Technology University, 2026, 25 (3): 15-24.

[2] Wang Shushen, Chen Yanhua, Zhuang Kaikun. The Current Situation, Problems and Countermeasures of Low-altitude Infrastructure Construction in China [J]. Journal of Shenyang University of Technology (Social Science Edition), 2026, 19 (2): 16-25.

[3] Zeng Fanlei. Low-altitude Economy Facilitating Urban Governance: Significance, Challenges and Paths [J]. New Oriental, 2025, (1): 40-46.

[4] Li Pengfei, Yang Mingfang. Low-altitude Economy Boosting the Upgrade of Urban Governance Levels: Logical Path, Realistic Dilemmas and Practical Paths [J]. Gansu Journal of Theory, 2026, (2): 109-118.