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## ENHANCING THE EFFECTIVENESS OF COMMAND AND OPERATIONAL COORDINATION IN FIREFIGHTING AND RESCUE OPERATIONS IN HIGH-RISE APARTMENT BUILDINGS FROM THE FUNCTIONAL PERSPECTIVE OF THE FIRE AND RESCUE POLICE FORCE

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### Abstract

*This study focuses on analyzing the characteristics of high-rise apartment buildings that are directly related to firefighting and rescue operations. It clarifies the roles, functions, and responsibilities of the Fire and Rescue Police Force in command and operational coordination in accordance with current legal regulations, with particular emphasis on the Law on Fire and Rescue enacted in 2024. On this basis, the paper evaluates practical implementation and proposes feasible solutions aimed at enhancing the effectiveness of command and operational coordination in firefighting and rescue activities in high-rise apartment buildings, thereby meeting task requirements under the new operational context.*

**Keywords:** *Firefighting and rescue; high-rise apartment buildings; firefighting command; Fire and Rescue Police Force...*

### 1. Introduction

The rapid process of urbanization in recent years has strongly stimulated the development of high-rise apartment buildings, particularly in major urban centers such as Hanoi. Alongside their significant economic and social benefits, this type of building also entails numerous potential risks related to fires, explosions, and complex incidents and accidents. Practical experience indicates that fires occurring in high-rise apartment buildings often result in extremely serious consequences, directly affecting human lives,

property, and social order and safety. Typical examples include the Carina Plaza apartment fire, which occurred at 00:30 on March 23, 2018, at No. 1648 Vo Van Kiet Street, Ward 16, District 8, Ho Chi Minh City, Vietnam, resulting in 13 fatalities, 70 injuries, and economic losses estimated at VND 126 billion; as well as the mini-apartment fire at 11:30 on September 12, 2023, at Alley 29/70 Khuong Ha Street, Thanh Xuan District, Hanoi, which caused 56 deaths and 37 injuries.

In this context, command and operational coordination in firefighting and rescue

operations plays a particularly critical role and is decisive in determining the effectiveness of incident response. The Fire and Rescue Police Force serves as the core force directly responsible for performing these tasks in accordance with its legally prescribed functions and responsibilities.

## **2. The role of command and operational coordination in firefighting and rescue operations in high-rise apartment buildings**

High-rise apartment buildings are characterized by complex architectural structures, high residential density, and diversified technical systems. When a fire occurs, it often generates a large volume of smoke and toxic gases that rapidly spread along the vertical axis, posing significant challenges to fire access and the organization of evacuation and rescue operations. Therefore, command and operational coordination must ensure unity, flexibility, timeliness, and accuracy in order to effectively mobilize and deploy forces and equipment, organize firefighting and rescue operations efficiently, and minimize human casualties and property losses to the greatest extent possible.

Command in firefighting and rescue operations is not merely the issuance of orders at the incident scene, but rather a comprehensive process involving situation assessment, anticipation of incident development, and the selection and continuous adjustment of tactical plans in accordance with the specific characteristics of each building and each operational phase. In the context of high-rise apartment buildings, the role of the incident commander is of paramount importance, as any error or inadequacy in on-site command and operational coordination may lead to extremely serious consequences.

## **3. Existing limitations and challenges in command and operational coordination of firefighting and rescue operations in high-rise apartment buildings**

*First, limitations in on-site command and operational organization*

Practical experience indicates that, although the Fire and Rescue Police Force has made considerable efforts in organizing command and operational coordination for fires

and incidents in high-rise apartment buildings, certain shortcomings remain evident in complex situations. The establishment of on-site command and staff units, as well as the assignment of responsibilities among functional sections, has at times lacked clarity and consistency. In emergency conditions involving multiple participating forces, command directives have occasionally been disrupted or insufficiently synchronized, thereby affecting overall operational effectiveness.

The primary causes of these shortcomings stem from the inherent complexity of high-rise structures, characterized by confined spaces, multiple floors, and various access routes, combined with the involvement of multiple agencies and forces. Without a well-defined and tightly organized command mechanism, such conditions are likely to result in overlapping or fragmented direction and control.

*Second, difficulties in initial situation assessment and the development of tactical plans*

In practical firefighting and rescue operations in high-rise apartment buildings, the collection of initial information to support command and operational decision-making remains challenging. Information regarding structural characteristics, technical systems, the location of the fire or incident, the number of trapped occupants, and the operational status of internal fire protection systems is often incomplete, inaccurate, or updated with delays.

Furthermore, some firefighting and rescue plans for high-rise apartment buildings were developed in advance but have not been promptly reviewed or adjusted to reflect changes in building functions, architectural modifications, or residential density. As a result, the application of these plans in real-world situations has been hesitant and has not achieved the desired level of effectiveness.

*Third, limitations in personnel, equipment, and access conditions*

Despite increased investment and attention, firefighting and rescue equipment for high-rise operations in certain localities remains insufficiently modern and synchronized when compared to practical operational requirements. Specialized equipment such as aerial ladder trucks, high-altitude rescue devices, and dedicated reconnaissance tools

is still lacking or does not adequately meet the height and scale demands of newly developed apartment buildings.

In addition, complex urban traffic conditions, limited access spaces, and the encroachment upon internal roads and parking areas within apartment complexes further hinder the deployment of forces and equipment, as well as the organization of firefighting and search-and-rescue formations in accordance with the incident commander's operational requirements.

*Fourth, insufficient coordination among participating forces*

In incidents and fires occurring in high-rise apartment buildings, in addition to the Fire and Rescue Police Force, various other actors are involved, including in-house firefighting units, local authorities, medical services, power utilities, and other relevant agencies. However, in practice, coordination mechanisms among these forces have not always been sufficiently well-integrated in certain situations. Information sharing, technical support, logistical coordination, and the maintenance of public order and security have at times been delayed or inadequately synchronized, thereby adversely affecting the overall effectiveness of command and operational coordination.

*Fifth, persistent risks in ensuring the safety of firefighting and rescue personnel*

Firefighting and rescue operations in high-rise apartment buildings inherently involve a high level of risk due to factors such as dense smoke, toxic gases, the potential for fire spread, localized structural collapse, confined spaces, and limited escape routes. Meanwhile, strict compliance with safety procedures and regulations in certain emergency situations remains challenging. In addition, personal protective equipment in some units is not yet fully adequate or synchronized, which negatively affects the ability of officers and firefighters to conduct operations safely and sustainably.

*Sixth, the application of science, technology, and digital transformation in command and operational coordination remains at an early stage*

At present, the development of comprehensive digital databases on high-rise apartment buildings to support command and operational coordination in firefighting and

rescue activities has not been implemented in a synchronized and systematic manner. The utilization of data from automatic fire alarm systems, surveillance cameras, and building management systems remains limited and has not yet been effectively integrated into on-site command operations.

Furthermore, the practical application of advanced technologies-such as unmanned aerial vehicles (UAVs), drones, thermal imaging cameras, and digital platform-based command systems-in firefighting and rescue operations in high-rise apartment buildings is still relatively limited. These technologies are largely used on a pilot or experimental basis and have not yet fully realized their potential in supporting incident commanders in situation assessment and decision-making processes.

**4. Proposed solutions to enhance the effectiveness of command and operational coordination in firefighting and rescue operations in high-rise apartment buildings**

Based on the legally prescribed functions and responsibilities of the Fire and Rescue Police Force, and with the aim of enhancing the effectiveness of command and operational coordination in firefighting and rescue operations in high-rise apartment buildings, the following integrated solutions should be implemented in a systematic and coordinated manner.

*First, improving the quality of unified on-site command and operational organization*

It is necessary to further refine and improve the organizational mechanisms for command and operational coordination in firefighting and rescue operations in accordance with the principles of centralized and unified command, ensuring clear assignment of personnel, tasks, and responsibilities, as well as the smooth transmission of command directives from the command post to operational teams. In this regard, the authority and responsibilities of the on-site incident commander at each phase of incident response should be clearly defined in order to minimize overlap and fragmentation in command and operational control.

In addition, priority should be given to enhancing command capacity through

systematic training, professional development, and the organization of drills closely aligned with complex fire, accident, and incident scenarios commonly occurring in high-rise apartment buildings, such as basement fires, vertical fire spread, localized structural collapse, and situations involving large numbers of occupants trapped at elevated levels. Through training and exercises, the leadership competence, situational judgment, and ability to make rapid and accurate decisions of incident commanders can be progressively strengthened, thereby meeting the practical demands of firefighting and rescue operations.

*Second, strengthening capacity for situation assessment and tactical planning*

Efforts should be intensified to improve the collection, integration, and analysis of initial information from the moment a fire alarm or incident report is received. This includes data on building characteristics, the location of the fire, the scale of the incident, the estimated number of potentially trapped occupants, access conditions, available water sources, and other emerging hazards. Accurate, comprehensive, and timely situation assessment constitutes a critical foundation for incident commanders to select appropriate, effective, and safe tactical options.

At the same time, emphasis should be placed on the development, review, and regular updating of firefighting and rescue plans tailored to each specific high-rise apartment building, ensuring consistency with actual architectural features, functional use, and technical infrastructure. During operations, incident commanders must flexibly adjust tactical plans in response to the evolving dynamics of fires, accidents, and incidents, while assigning the highest priority to life-saving missions, minimizing property losses, and ensuring the safety of forces engaged in firefighting and rescue activities.

*Third, strengthening investment in personnel and equipment tailored to the specific characteristics of high-rise apartment buildings*

Continued attention should be given to investment in and procurement of modern and specialized firefighting and rescue equipment designed for high-rise buildings, including aerial ladder trucks, high-pressure fire engines, high-altitude rescue devices,

specialized reconnaissance tools, and dedicated communication systems.

In parallel, measures should be implemented to address existing challenges in accessing incident scenes. This requires close coordination with local authorities and apartment building developers to ensure the availability of internal access roads and suitable deployment areas for firefighting and rescue vehicles, thereby effectively supporting command and operational coordination as well as the organization of tactical operations.

*Fourth, enhancing the effectiveness of organization, mobilization, and coordination among forces and equipment*

Coordination mechanisms between the Fire, and Rescue Police Force and in-house firefighting units, local authorities, medical services, power utilities, and other relevant agencies should be further refined throughout firefighting and rescue operations in high-rise apartment buildings. The focus should be placed on developing clear and specific coordination protocols that define the responsibilities of each participating force, along with strengthening inter-agency training and joint exercises. These measures aim to ensure timely and unified information exchange, maximize collective operational capacity, and enhance the effectiveness of command and operational coordination in handling complex fires, accidents, and emergency incidents in high-rise apartment buildings.

*Fifth, reinforcing safety assurance throughout operational activities*

Regular inspection and supervision of compliance with safety procedures, regulations, and requirements in both training and operational contexts should be maintained. Adequate provision of personal protective equipment for officers and firefighters must be ensured. At the same time, emphasis should be placed on training and strengthening safety-related skills and techniques in order to enhance operational proficiency, reduce risks, and minimize occupational accidents during firefighting and rescue operations.

*Sixth, promoting the application of technology and digital transformation in command and operational coordination*

Priority should be given to the development and completion of comprehensive

digital databases on high-rise apartment buildings, including information on structural characteristics, technical systems, access and evacuation routes, and water sources serving firefighting and rescue operations. At the same time, greater emphasis should be placed on strengthening connectivity and effectively exploiting data from automatic fire alarm systems, surveillance cameras, and building management systems in order to provide timely and accurate support for on-site command and operational coordination.

Concurrently, the application of advanced technological equipment and tools in firefighting and rescue operations should be intensified. Particular attention should be paid to the use of unmanned aerial vehicles (UAVs) for aerial reconnaissance missions, enabling the collection and real-time transmission of images and data related to fire development, smoke and toxic gas spread, the location of victims, and potential hazards such as structural collapse and fire propagation. On this basis, incident commanders are provided with a scientific foundation for situation assessment, tactical adjustment, and the timely, effective, and safe organization of firefighting and life-saving operations.

In addition, further research and gradual application of specialized UAVs and

drones should be undertaken for tasks such as the deployment of firefighting agents, lighting support, evacuation guidance, and assistance in accessing and rescuing victims in elevated or hard-to-reach locations. These efforts should be integrated with the use of thermal imaging cameras and digital platform-based command and control systems, in conjunction with training and capacity-building for technologically proficient human resources, in order to meet the requirements of digital transformation in the operations of the Fire and Rescue Police Force in the current context.

## 5. Conclusion

Enhancing the effectiveness of command and operational coordination in firefighting and rescue operations in high-rise apartment buildings is an urgent requirement in the context of rapid urbanization and the increasing development of high-rise housing. As the core force in this field, the Fire and Rescue Police Force must continue to fully perform its assigned functions and responsibilities, while constantly innovating and improving the quality of command and operational coordination in order to meet the requirements of protecting human lives and property and ensuring public safety under the new operational context.

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