

Operational Direction of Regional Building Safety(RBS) Center for Preliminary Review of Architectural Administration in Korea

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Abstract

In Korea, local government officials are in charge of buildings, and as such are supposed to review submitted documents related to the architectural administration to ensure that they comply with the legal standards. However, these officials generally put a greater emphasis on the preparation of the set of documents required for the administrative work than the content the documents contain. For this reason, many experts point out that the shortage of officials specialized in buildings and construction, as well as the lack of expertise among the building officials in the local governments, may result in repeated safety accidents during building construction. The purpose of this study is to propose the operational direction of a Regional Building Safety (RBS) center to secure the performance and safety of buildings by utilizing private resources. In this study, we carried out a pilot project to verify the effects of an RBS center and to derive the specific number of experts required. As a result, the technical matters were resolved in approximately 15% of the total cases of the document processing procedure, and the level of technical specialization among the officers has also been improved through the provision of guidance. The research findings support the validity and effects of the introduction of the RBS center. Finally, this study proposes (1) the types of RBS Centers that should be established, (2) the roles and business scope of the RBS Center, (3) the specific number of experts required, (4) the qualifications of the experts, and (5) the business regulations of the RBS Center.

Keywords : building safety, architectural administration, preliminary review, regional building safety center

1. Introduction

The building sector is one of the most dangerous sectors of industry [1–3]. Over the past several years, many studies on building safety have specifically focused on the causes of safety accidents and risk management during the construction phase[4–9].

However, in many cases, casualties and property damage are still aggravated by the defects of buildings [10–12]. One of the major causes of safety

accidents arising from defects of buildings is negligence in the control and supervision of faulty design or construction. Specifically, it is difficult to say that the review of building permits, completion, and approval for use done by the government officials is adequately conducted in compliance with the related legal standards in Korea. This is because the building officials in local governments of Korea must review the submitted documents relating to architectural administration, and judge whether or not to these comply with legal standards. Their review mostly focuses on whether a full set of required documents are submitted or not. Yu et al.[13] points out two primary reasons for this formality-based approach. The first is the lack of professionalism among these public officials due to the job rotation

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system. The second is a lack of time to thoroughly review the safety and quality of buildings due to an inadequate number of public officials in charge.

Therefore, building safety is entirely dependent on the judgment of experts, such as the registered architects and structural engineers who design the buildings. However, these individuals have limitations when it comes to finding errors in their own designs, and often overlook faults, or even intentionally commit illegal acts. When the MOLIT (Ministry of Land, Infrastructure, and Transport) of Korea investigated some constructions works regarding optimal design and construction in terms of structural design and fire safety, the findings in 2015 showed that 27% of construction sites were non-conforming, while 16% of sites were non-conforming in 2016[14].

In the current administrative procedure of Korea, it is hard to identify such faulty design or other factors before a safety accident occurs. For this reason, the parties responsible for accidents are punished only after some damage to human life or property occurs. To secure building safety, it is necessary to find out through technical means, prior to building permission, whether a relevant building conforms to architectural standards.

On this background, this study aims to propose a preliminary review system for an architectural administration of Korea to prevent illegal acts and secure the performance and safety of buildings. With this system, local government officials may discover the faulty design or other factors in advance of the permission phase, rather than finding violations of laws and taking corrective action after the construction of a building has commenced.

As architectural administration is carried out at the level of primary local governments, in principle, the preliminary review systems must be established at the local government level, considering the geographic scope of business service performance, workload, and the characteristics of business services. The

institution in charge of the preliminary review system for a series of architectural administration, including building permit review, was named the ‘Regional Building Safety Center’ (hereinafter “RBS Center”).

This study used the following methods to establish the direction of operation for the RBS Center.

First, directions concerning the review scope of the RBS Center, the method of its operation, qualification for experts, business regulations and others were set after consulting with an expert group consisting of architectural administration officials in charge of building permissions in Korea, related associations, registered architects, and engineers.

Second, a pilot project was carried out to verify the effectiveness of the building permission preliminary review system and the number of experts required.

Finally, the direction of operation for the RBS Center was proposed by summarizing these results.

2. The Roles and Duties of the RBS Center

In introducing the RBS Center, it is necessary to clearly define the roles of existing building officials and the expert(s) in the RBS Center.

The purpose of the RBS Center is not to reduce the burden on building officials, but to root out faulty and illegal building acts through the RBS Center’s direct verification and review of the conformity of design documents to architectural and structural standards. This work used to be performed by building officials, thus breaking away from the practices that used to depend entirely on the judgment of registered architects and structural engineers.

Therefore, this study defined the roles of building officials and the RBS Center, and these are provided in Table 1.

The role of the RBS Center is limited to technical verification and review in architectural administration; however, arbitrary interpretation of the scope of

technical reviews is possible, and the range of the duties defined for building officials and the RBS Center may vary according to the local governments. Thus, the following principles for defining the scope of responsibilities of the RBS Center were suggested [14]:

- 1) Meeting the purpose of establishing the RBS Center: Its scope of duties shall be limited to architectural administration requiring judgment on conformity based on technical knowledge for the enhancement of building safety, and exclude the simple checking of whether documents were submitted or not.
- 2) Excluding duties not related to building safety: Tasks not related to safety, such as building agreements, shall be excluded.
- 3) Restricted to parts and levels that may be reviewed within the current legal boundaries: The scope of duties shall be defined in consideration of processing time limits and required documents according to business acts prescribed by law.
- 4) Excluding repeated duties – the certification and review of which are conducted by specialized third-party institutions. Specifically, for items such as the review of structural safety for skyscrapers and the examination of asbestos, their certification and review are conducted by specialized third-party institutions and shall be excluded from the duties of the RBS Center.

Based on the above principles for defining the scope of duties, the authors prepared the primary draft of the scope of work for the RBS Center. They conducted a revision and supplementation after consultation meetings with relevant specialists from the Korea Institute of Registered Architects, the Korean Structural Engineers Association, the Korea Professional Engineer Architectural Execution Association, and other societies. The scope of duties was finally determined after being reviewed by building officials of local governments, as shown in Table 2.

Table 1. The roles of building officials and the RBS center

Classification	Roles
Building Officials	Confirmation of attached documents on ownership, the scope of site, etc in the process of architectural administration; confirmation of acts related to legal requirements such as the building code that can be identified externally; and the issuance of permits
RBS Center	Report, review, examination, and inspection pertaining to architectural administration that requires technical judgment

Table 2. Duties of the RBS center

Category	Contents
The review and verification of compliance with the building code	<ul style="list-style-type: none"> • Review on the adequacy of fire-proof construction and fire-protection construction • The verification and review of building finishing materials • Review on the adequacy of interior construction • Review on the adequacy of structures of basement levels • Review on compliance with emergency escape provisions • Review on the adequacy of vertical circulation • Field investigation • Consulting about safety inspection • Technical support to maintenance • Review of inspection report and supervision report
The review and verification of compliance with the structural code	<ul style="list-style-type: none"> • Structural design codes and load compliance • The compliance of materials and construction method • The compliance of structural design and construction drawing • Review on the structural design of non-structural components • Geotechnical investigation and the compliance of earth retaining design • Field investigation • Consulting about safety inspection • Technical support to maintenance • Review of inspection report and supervision report

3. Establishment of the RBS Center

3.1 Approaches to Establishing the RBS Center

If it is impossible to establish the RBS Center under a local government due to the characteristics of that local government, such as lack of workforce or finance, then two or more local governments can co-establish and operate an RBS Center.

Private sector resources should be used for the RBS

Center due to the difficulty in increasing the number of public officials. However, the RBS Center should carry out business services transparently and fairly, and be subject to the control and supervision of a local government. Approaches to establishing RBS Centers were reviewed in consideration of such organizational characteristics.

It is suggested that an RBS Center should be established by selecting one of the following models: ① direct management, in which the local government directly establishes and operates the RBS Center on its own; ② public foundation, in which a foundation corporation is established, and operates the RBS Center; and ③ entrustment to public enterprise, in which the operation of the RBS Center is entrusted to a local public enterprise.

In the direct management model, the RBS Center can secure a stable budget because a local government appropriates the budget. Moreover, the operational budget for securing space for the RBS Center, etc. can be reduced, because it can use space and equipment within government buildings. In addition, the RBS Center can deliver quick responses to civil petitions as well as organic reactions through cooperation with building officials when possible. On

the other hand, experts will need to be employed on a fixed-term contract due to the structure of the governmental organization, and the wage will be relatively low compared with private sector work. This means that experts, who can find jobs relatively easily, will have insufficient incentives to work at the RBS Center.

As for the public foundation model, while it solves the problem of securing the budget for the RBS Center because a local government invests in the RBS Center, the local government is forced to bear the heavy burden of establishing the foundation and securing its budget. The problem of insecure employment posed by the direct management model can be solved because the expert is employed as a permanent worker, and autonomy and flexibility in the operation of business services can be secured. However, given the characteristics of the RBS Center that has difficulty in conducting a profit-making business, the RBS Center cannot help but rely on the revenue resources of the local government. As a result, there may be a difficulty with providing rapid consultation and responses to civil petitions because it is spatially separated from building officials.

As for the model in which the operation of the RBS

Table 3. The strengths and weaknesses of RBS center operation models

Type	Strength	Weakness
Direct management by a local government	<ul style="list-style-type: none"> Stability of funding is secured Organic responses are enabled, such as cooperation with public official in charge of architectural administration Funding requirements for the space of the Center, etc. are reduced 	<ul style="list-style-type: none"> Employment insecurity of Center's experts Low payment for Center's experts Increased burden on local government for the establishment and operation of the Center
Establishment of a public foundation	<ul style="list-style-type: none"> Resolves the problem of securing budget Resolves employment insecurity of Center's experts Secures autonomy and flexibility of business operation 	<ul style="list-style-type: none"> Need to establish foundation, restrictions in terms of securing budget Limitation on stable operation as characteristics of the Center impose difficulty in conducting profit-making business Difficulty in immediate feedback from building officials
Entrustment to a local public enterprise	<ul style="list-style-type: none"> Burden on local government of establishing and operating the Center is reduced. Independence and autonomy in operation are significantly higher than in the model of direct management by a local government. Funding required for the initial establishment, such as securing Center space, is reduced. Employment insecurity of Center's experts is resolved. 	<ul style="list-style-type: none"> Restriction in securing a stable budget Difficulty in immediate feedback from building officials A limited number of local public enterprises suitable for the business services of the Center

Center is entrusted to public enterprise, the burden on a local government of establishing and operating the RBS Center is reduced, and the budget needed for the initial establishment, such as the cost of securing space for the RBS Center, can be lowered. On the other hand, it is likely that a local government will entrust the review work case by case, and thus securing a stable operational budget may be difficult depending on the number of cases entrusted. Therefore, when entrusting the RBS Center to a public enterprise, a minimum annual entrustment fee needs to be set. In addition, it has the limitation that there are a small number of public enterprises belonging to local governments that can suitably provide a preliminary review service of architectural administration. Characteristics of the models for establishing the RBS Center are summarized in Table 3.

3.2 Qualification for Experts

Experts who conduct technical reviews at the RBS Center must have specialized knowledge in a range of areas, including building plan and design, the ground, architectural structure, construction, and equipment.

The qualification needs to be limited to engineers and registered architects in the relevant areas through consultation with experts, since the purpose of the RBS Center is not to examine designs but to verify and review technical matters related to the safety of buildings. In addition, they suggested that considering issues to be dealt with by architectural administration, priorities in the placement of experts to the RBS Center should be set in the order of architects and structural engineers, architectural execution engineers, mechanical facilities engineers, and geology engineers. However, looking at the status of technical experts across the country, it is apparent that while large cities are capable of review in all of the specialized areas of expertise, provincial

cities lack human resources in the fields of structure, mechanical facilities, and the ground. Therefore, for the fields in which it is challenging to secure engineers, it was suggested that the qualification should be expanded not only to engineers but also to special-grade engineers in the relevant areas set forth by the Enforcement Decree of the Engineering Industry Promotion Act, as follows:

- 1) 1 or more registered architect(s) (required)
- 2) 1 or more expert(s) relating to structure (required)
 - Structural engineer
 - Special-grade engineer relating to structure
- 3) Engineers relating to architectural execution, mechanical facilities, and the ground (optional)
- 4) Special-grade engineers relating to mechanical facilities and the ground (optional)

3.3 Business Regulations and Discipline of RBS Center Staff

Staff members of the RBS Center should provide the relevant business services in a fair and transparent manner, considering that the mission of the RBS Center is to contribute to the promotion of public safety and welfare. Therefore, the RBS Center staff members are prohibited from engaging in profit-making business and required to comply with the Local Public Officials Service Regulations in connection with holding concurrent offices.

Furthermore, in the event that it is necessary to apply the provisions of Articles 129 to 132 of the Criminal Act and the penalties under Articles 2 and 3 of the Act on Aggravated Punishment, etc. of Specific Crimes to the performance of technical reviews in architectural administration, the staff members are regarded as public officials, and any staff member who engages in fraud in the course of conducting the RBS Center's business services is subject to penalties under Article 109 of the Building Act.

4. Pilot Project for the RBS Center

4.1 Operation and results of Pilot Project

A pilot project was carried out to verify the effects of experts' preliminary review in architectural administration, and to derive detailed operational directions such as the number of buildings that can be reviewed and the specific number of experts required. Sejong, Korea was selected as the target area of the pilot project, which was carried out from October 24, 2017, to November 24, 2017 (32 days in total).

Review duties were restricted to building permits, building reports, construction commencement reports, approvals for use, and safety-related matters requiring technical reviews, among other administrative services. Based on the characteristics of comprehensive review services, the review services are divided into three parts: the building area, which deals with building plans and fire safety; the structural area, which deals with the ground and architectural structure safety; and the expert area, which consists of one registered architect and one structural engineer.

We chose to implement the direct management method, in which the local government directly employs and manages experts, as the operation model. At the time of the pilot project, there were no institutional foundations that allowed experts to directly request the supplementation of design documents, etc. from a civil petitioner because the preliminary review system had not been legally established. Therefore, as shown in Figure 1, the business flow of the pilot project consists of the following steps: 1) upon receiving a civil petition, a public official in charge sends a request for review to the expert, 2) after the review, the expert decides on conformity or supplementation required, 3) the public official requests supplementation from the civil petitioner, and 4) after the expert's re-examination of supplemented matters, the procedure of permission, report, and approval is completed.

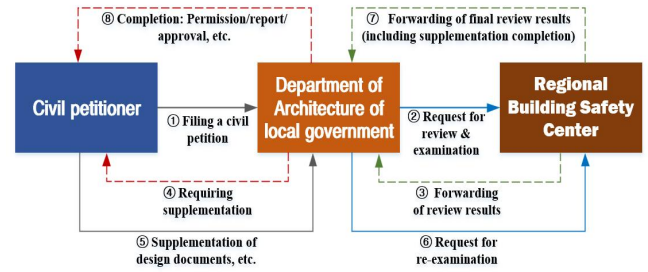
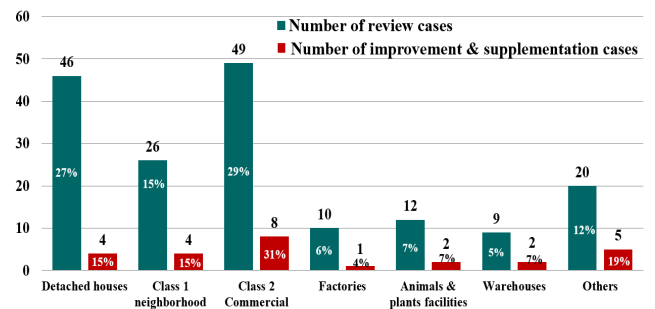
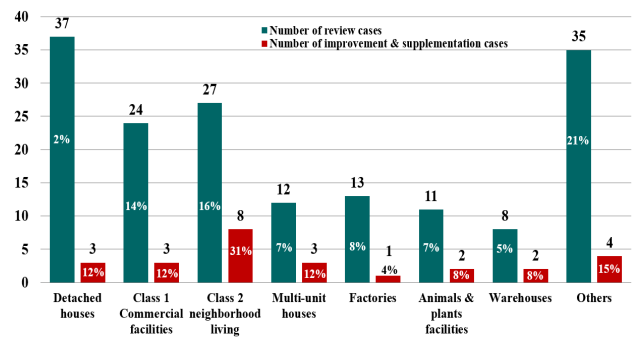


Figure 1. Work process of the pilot project

During the period of the pilot project, 172 cases in the area of building construction and 167 cases in the area of the structure were reviewed. Of these, 26 cases in the area of building construction and 26 cases in the area of the structure were re-examined after the expert required their improvement and supplementation, showing improvement effects of 15.12% and 15.57%, respectively (Figure 2). It was found that most cases of illegality or faulty design were related to fire safety, such as fire compartment, faulty structural design, and/or inadequate drawings.



(a) Building sector



(b) Structure sector

Figure 2. Number of processing and improvements by use in the pilot project

Through analyzing the mean processing time spent for building permits and reports in the area of building construction, it was found that an average of 32 minutes was spent per case of building reports and an average of 63 minutes per case of building permits. In the area of structure, it was found that 34 minutes was spent per case of building reports and 57 minutes per case of building permits. The analysis showed that the overall average processing time was approximately 45 minutes per case (Table 4).

Table 4. Mean work processing time of the pilot project

Classification	Building report		Building permit	
	Building	Structure	Building	Structure
Mean processing time	32 mins.	34 mins.	63 mins.	57 mins.
Mean gross floor area	176.97 m ²		689.58 m ²	

Also, it was found that while for buildings with a gross floor area from 100m² - less than 1,000m², an almost identical amount of time was spent for review, while for buildings with a gross floor area over 1,000m², more time was spent for review as the gross floor area increased. For example, while the average time required for the review of compliance with the building code was 52.5 minutes for buildings with a gross floor area of 500m² -1,000m², it was an average of 85.7 minutes for buildings with a gross floor area of 1,000m²-3,000m², which is approximately 1.63 times the former.

In the city of Sejong, where the pilot project was carried out, generalization is somewhat tricky because most of the city's buildings are small, and in comparison to other large local governments, their uses are not diverse. It was found, however, that the pilot project contributed to the actual architectural administration as it identified many faulty designs out of designs that had already been reviewed by building officials. It enabled judgments of compliance to be made regarding technical matters that were difficult for building officials to judge.

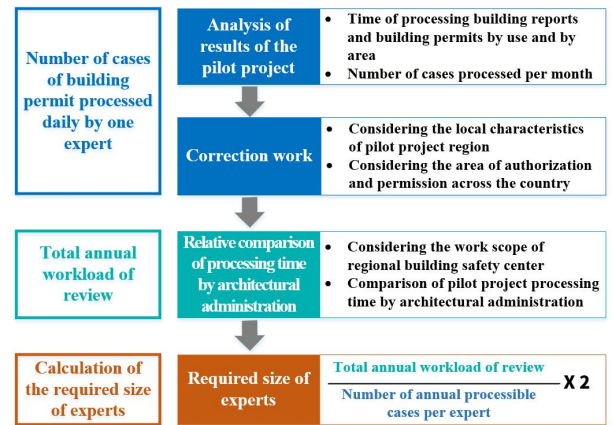


Figure 3. Process of calculating the number of experts required for RBS center

4.2 Calculation of the number of experts required

The process of calculating the number of experts required for the RBS Center is shown in Figure 3.

As for the number of required experts, the total number of experts was calculated by determining the number of cases that can be processed by one expert in one year and comparing it with the total volume of review services in architectural administration. The number of processible cases was calculated based on the results of the pilot project, taking into account the size of buildings and the specificities of provincial areas and large cities. As for the total volume of review services, the time required for other architectural administration was comparatively derived based on the processing time of the pilot project, with the building permit being 1.

According to the statistics of E-AIS[15], the ratio of 1,000m² or above in gross floor area among buildings subjected to building permission varies by region, with 11% in the Seoul Capital Area, 13% in metropolitan cities, and 6% in dos (Figure 4). The average gross floor area of buildings reviewed in the pilot project was 689,58m², and most buildings were small. Since review processing time varies according to the area, it is necessary to make a distinction between provincial regions and large cities to calculate the number of experts required.

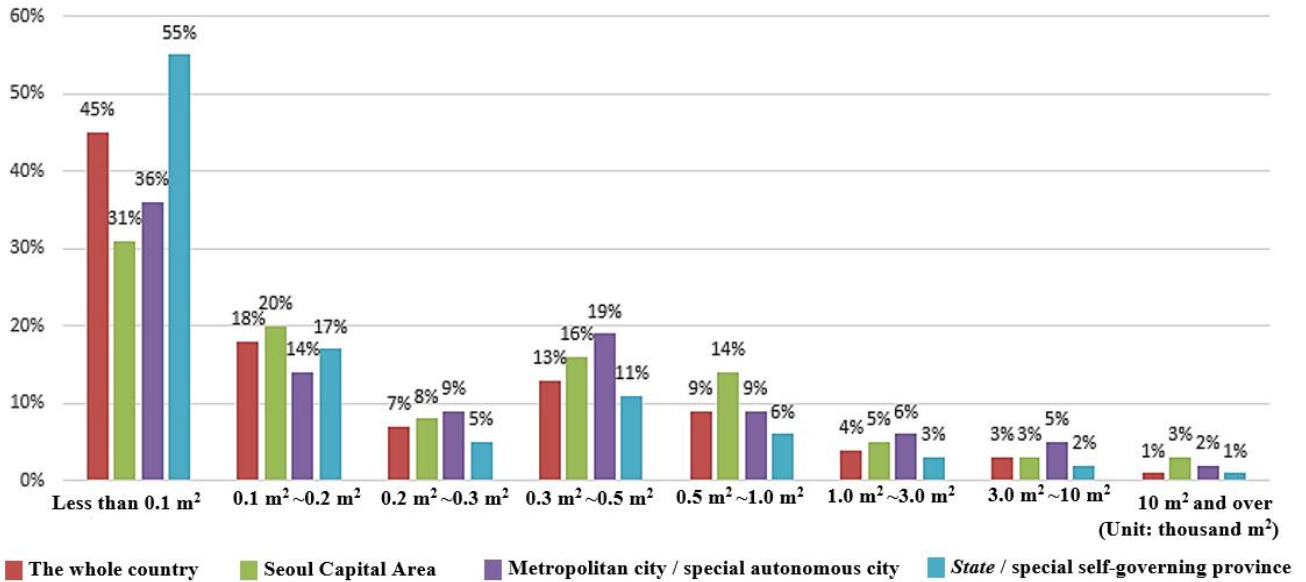


Figure 4. Status of building permits by gross floor area in 2015 (Source: E-AIS, 2015)

Based on the results of the review of the pilot project, if the building permit workload is 1.6 for 1,000m²-3,000m², 1.8 for 3,000m²-10,000m², and 2 for 10,000 m² and over, with the benchmark 1 for less than 1,000 m² in gross floor area, the workload of large cities increases to 1.23 times, compared with provincial areas including small cities. Considering the average gross floor area in provincial regions and large cities, 7 cases were selected as the number of cases of building permits processed daily in provincial areas, and 5 cases in large cities, respectively. This is applied to the manpower required for reviewing compliance with the building code, and the same is applied to the manpower required in the review of compliance with the structural code.

On the other hand, based on the results of processing time in the pilot project and the number of cases of building permits according to size, the number of buildings required for the total volume of building examination business services shall be the total value calculated in Table 5.

By putting these together, we suggested the number of experts required for the RBS Center, as shown in Table 6.

Table 5. Relative comparison of processing time according to architectural administration

Architectural administration	Relative comparison of processing time
Building report	<ul style="list-style-type: none"> Provincial areas: 0.5 of building report cases Large cities: 0.36 of building report cases
Building permit	<ul style="list-style-type: none"> 1.0 of building permit cases irrespective of regions
Other duties	<ul style="list-style-type: none"> 0.4 of building report and permit cases irrespective of regions

Table 6. Number of experts in the RBS centers

Division of regions	The number of experts
Large city	$\frac{0.76a + 1.4b (= a \times 0.36 + b + (a + b) \times 0.4)}{1,260 (= 5 \text{ cases per day} \times 21 \text{ days} \times 12 \text{ months})} \times 2$
Provincial area	$\frac{0.9a + 1.4b (= a \times 0.5 + b + (a + b) \times 0.4)}{1,764 (= 7 \text{ cases per day} \times 21 \text{ days} \times 12 \text{ months})} \times 2$

(Note) a: the average number of cases of building reports to a relevant local government over recent 3 years
 b: the average number of cases of building permits by a relevant local government over recent 3 years
 ※ Round off to the nearest tenth.

5. Conclusion

In the current architectural administration of Korea, authorization & permission and approval regarding

building safety, which requires specialized technical verification, is granted by solely relying on the judgment and conscience of engineers in charge of their design. Even if a building safety accident occurs, the emphasis is given to the punishment of a relevant public official and the piecemeal improvement of the system. Consequently, safety accidents of buildings occur each year, repeatedly.

Therefore, this study proposed the introduction of the RBS Center to prevent illegal acts and secure public safety by performing technical reviews on design documents at the permission phase. Specifically, this expects to identify violations of the building code before the commencement of construction and reduce the need to take corrective action afterward.

Taking into consideration the real burden and the difficulty in reaching a social consensus on the radical opening of architectural administration to the private sector in Korea, we set a guide for establishing an RBS Center that can support public officials through the use of human resources from the private sector without increasing the number of public officials. Accordingly, the business scope of the RBS Center was limited to technical reviews based on specialized knowledge.

A pilot project was carried out to verify the effects of the RBS Center and the number of experts required. Consequently, the improvement and supplementation of technical matters were achieved in approximately 15% of the total cases processed, which confirmed the validity and effects of the introduction of the RBS Center.

In summarizing these results, we propose the following direction of operation for such an RBS Center:

- 1) Models for the establishment of the RBS Center
In consideration of the characteristics of local governments, it was suggested that the model for the RBS Center be selected from among direct management, public foundation, and entrustment to public enterprise. The strengths and weaknesses

of each type were presented.

- 2) Roles and the scope of duties of the RBS Center
The roles of building officials were defined as confirming whether or not required documents were submitted, verifying statutorily required acts, and the issuance of permits, and the roles of the RBS Center were defined as performing review and examination with regard to architectural administration requiring technical judgment. Further, principles for defining the work scope of the RBS Center were established, and the specific duties of the RBS Center regarding building safety were suggested.
- 3) Qualification for experts
Qualification for experts was suggested in consideration of the distinct characteristics of business services and the regional demand and supply of experts.
- 4) Business regulations
Given that the business services of the RBS Center should be performed strictly and transparently, the staff members of the RBS Center should be made to comply with the Local Public Officials Service Regulations, and were regarded and dealt with as public officials in connection with disciplinary action related to their business services.
- 5) The number of experts required
The number of cases that experts could process was derived from the results of the pilot project. The formulas for calculating the number of experts were separately proposed for provincial areas and large cities after reviewing the processing time according to gross floor areas and the number of permit cases according to region.
According to an interview survey with public officials and relevant experts on the introduction of the above preliminary review system for the architectural administration, the biggest hindrance to establishing an RBS Center was financial resources. One way to resolve the insufficient financial resources was levying

a charge for compelling compliance imposed on illegally constructed buildings by each local government. However, it is necessary to proactively consider fiscal support at the state level as a preemptive measure for the safety of the public and as a method to build sound stock to minimize social costs in the long-term. It is deemed necessary in the long term to secure stable revenue sources by creating a beneficiary pays system, such as review fees, an approach pursued in other countries that secure revenue sources for operation from review fees.

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