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Strategies for Rationalizing Structural Safety Assessment and Review systems in Architectural Design

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SUMMARY

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Various safety-related systems are operated with the objective of preventing safety accidents in buildings. However, as each system operates under individual laws and standards, review items and content duplication occur. For example, similarities are observable in the ground evaluation items of the building safety impact assessment and the underground safety assessment, as well as tunneling deliberations.⁴⁶⁾ Moreover, the lack of clarity in the operating principles for evaluation and deliberation at each stage has also been identified as a factor leading to decreased consistency in outcomes.

When building accidents occur, the evaluation and deliberation procedures to verify safety continuously increase, imposing temporal and economic burdens on building owners and designers. Additionally, in responding to repetitive evaluations and deliberations, the concentration on core design tasks may diminish, potentially leading to a decline in design quality and, consequently, a reduction in the system's effectiveness.

This study recognizes these issues and aims to secure institutional efficiency by

46) Chae Ji-yong et al. (2021, p.62); Kwon Jae-hyun, 2018. Dong-A Ilbo press release, <https://www.donga.com/news/article/all/20180909/91896994/1> [accessed: 2024.1.2.]

examining the issues and improvement tasks in the operation procedures of the structural safety assessment system during the building design process.

Current Issues in Building Structural Safety and Institutional Status

In Chapter 2, the current status of major domestic laws and systems related to building structural safety was examined, and the limitations of policy responses were explored. As collapse accidents and sinkhole accidents in urban centers due to design errors, changes, and lack of verification continued to occur, building safety impact assessments and structural safety reviews to verify the structural safety of the design process were implemented in response to individual accident causes. The underground safety evaluation system has been newly established and strengthened, which raises the following issues in the operation of the system.

Firstly, in the process of strengthening regulations in response to individual accident causes, issues concerning the timeliness of the design stage and system operation have emerged. The time of operation of each system is divided into the building safety impact assessment (prior to the approval of construction start reports), underground safety assessment (prior to construction commencement), structural safety deliberations (prior to construction commencement), and excavation review (prior to construction commencement). If the structural design is changed after the building safety impact assessment, subsequent verification is not possible. Therefore, this results in a double procedure where follow-up measures after the building safety impact assessment must be confirmed again through the structural safety review before construction.

In addition, the Building Act stipulates that the results of the building safety impact assessment must be confirmed through the structural safety review of the local government's specialized committee, but the Building Act stipulates that the structural safety review of the specialized committee must be conducted before construction begins, resulting in a procedural contradiction that requires a change in the permit content if the results of the review or consultation occur at the confirmation stage. In

addition, despite the ground rules stipulating that items can be excluded from the building safety impact assessment if the underground safety assessment has been conducted, it is not possible to conduct the assessment agenda in practice because the underground safety assessment is conducted before construction, so both the building safety impact assessment and the underground safety assessment must be conducted. It is necessary to clarify the scope and operating standards of the evaluation and review considering the confusion in the process and the design stage of the building (basic design before permit, implementation design after permit but before construction).

Secondly, the evaluation and deliberation systems related to building safety are operated separately according to individual laws, with insufficient interconnection. The management entities for each system—building safety impact assessment and final deliberation, underground safety assessment, tunneling deliberation—are separated (local governments and the state, evaluation and deliberation agencies), and the lack of connection hinders mutual monitoring and feedback on evaluation and deliberation results. Consequently, multiple evaluation and deliberation procedures are applied to a single building, and differences in interpretation among management entities regarding the reflection of results at each stage and re-evaluation and consultation reduce the predictability of evaluation and deliberation outcomes.

Thirdly, overlapping application and inefficiency issues arise among the evaluation and deliberation systems related to building safety. Redundancies in ground safety assessment items are commonly raised among evaluation and deliberation systems, which may lead to excessive regulation and unnecessary public resource waste. As specified above, since deliberation standards and procedures are unclear, confusion occurs during practical application. Due to frequent re-evaluations and re-deliberations, overlapping among systems should be resolved, and clear standards should be established to enhance efficiency.

Current State of Operation of Structural Safety Assessment and Deliberation Systems in the Building Design Process

In Chapter 3, in-depth interviews with designers and operators involved in evaluation and deliberation and expert perception surveys were conducted to identify issues in the domestic operation process of structural safety assessment and deliberation and set directions for institutional improvement. The main issues identified in system operation are as follows.

Firstly, the overlapping content and procedural aspects in evaluation and deliberation systems must be resolved and differentiated. Based on all respondents, 49.1% indicated that there is redundancy among systems, and the higher the overall understanding and expertise in the system, the higher the perceived redundancy (52.8% among 732 respondents knowledgeable about the entire system, and 64.1% among 145 respondents with high system understanding and extensive evaluation and deliberation committee experience). In the in-depth interviews with designers and operators, it was also difficult to clearly recognize system differentiation from the designers' perspective. Furthermore, regarding the priority of system improvement, simplifying overlapping evaluation and deliberation procedures and submissions was identified as the top priority. Considering the procedural overlapping issues in evaluation and deliberation systems as experienced by designers, it is necessary to explore measures such as differentiating the operating purposes and integrating systems in a manner that regulated parties can agree with.

Secondly, the timing and effectiveness of building safety impact assessments and final deliberations must be reviewed to ensure their timeliness and effectiveness. Currently, building safety impact assessments and final deliberations are required to be completed before building permits. However, in responses regarding the appropriate timing, the 'before construction start report' appeared to have a similar proportion to the 'before building permit.' Reasons include inadequate levels of design documents at the permit

stage, the application of performance-based design, and the existence of some review items that can be finalized at the final design stage, such as wind and environmental conditions. Considering the possibility of design changes after assessment and the progress level of design documents at the permit stage, conditions are needed that allow flexible institutional application and cues to adjust from before building permits to before construction start reports.

Thirdly, a division of roles between the state, local governments, and specialized agencies, considering the capacity levels of local governments, is necessary. There is a prevailing perception that differences in building administrative capacities and construction industry capabilities by region affect the assurance of building structural safety, and there is a high preference for expanding or strengthening national government monitoring or specialized agency evaluation and consulting functions. Notably, among government official respondents, the necessity to broaden or strengthen national government monitoring or specialized agencies was responded to at a higher rate than by the general public, suggesting that local government departments responsible for building permits bear a significant workload in structural safety verification tasks. However, in a separate question, a high proportion of responses indicated the need to strengthen the function of local government specialized committees when conducting building safety-related permit consultations and tasks. This suggests that the system needs to be improved in the long term to enable local governments to perform proactive duties in verifying and managing the structural design of buildings, considering regional and site conditions.

Fourthly, to improve the decision-making process in system operation, a system for sharing evaluation and deliberation results must be established to enable inter-system connections and monitoring. Interviews with designers and operators confirmed that it is challenging to track subsequent actions after safety impact assessment results and verify whether evaluation results have been reflected due to current system conditions. Additionally, it was identified that the previous stage's evaluation results are not sufficiently reviewed before proceeding to subsequent deliberations, leading to potential conflicts in deliberation opinions. To resolve these issues, it is necessary to establish a cooperative and sharing system that allows the sharing and reviewing previous evaluation results.

Improvement Measures for the Rational Operation of Building Safety Assessment and Deliberation Systems

Based on the research findings from Chapters 2 and 3, we have derived institutional improvement tasks to rationalize the current system's operation.

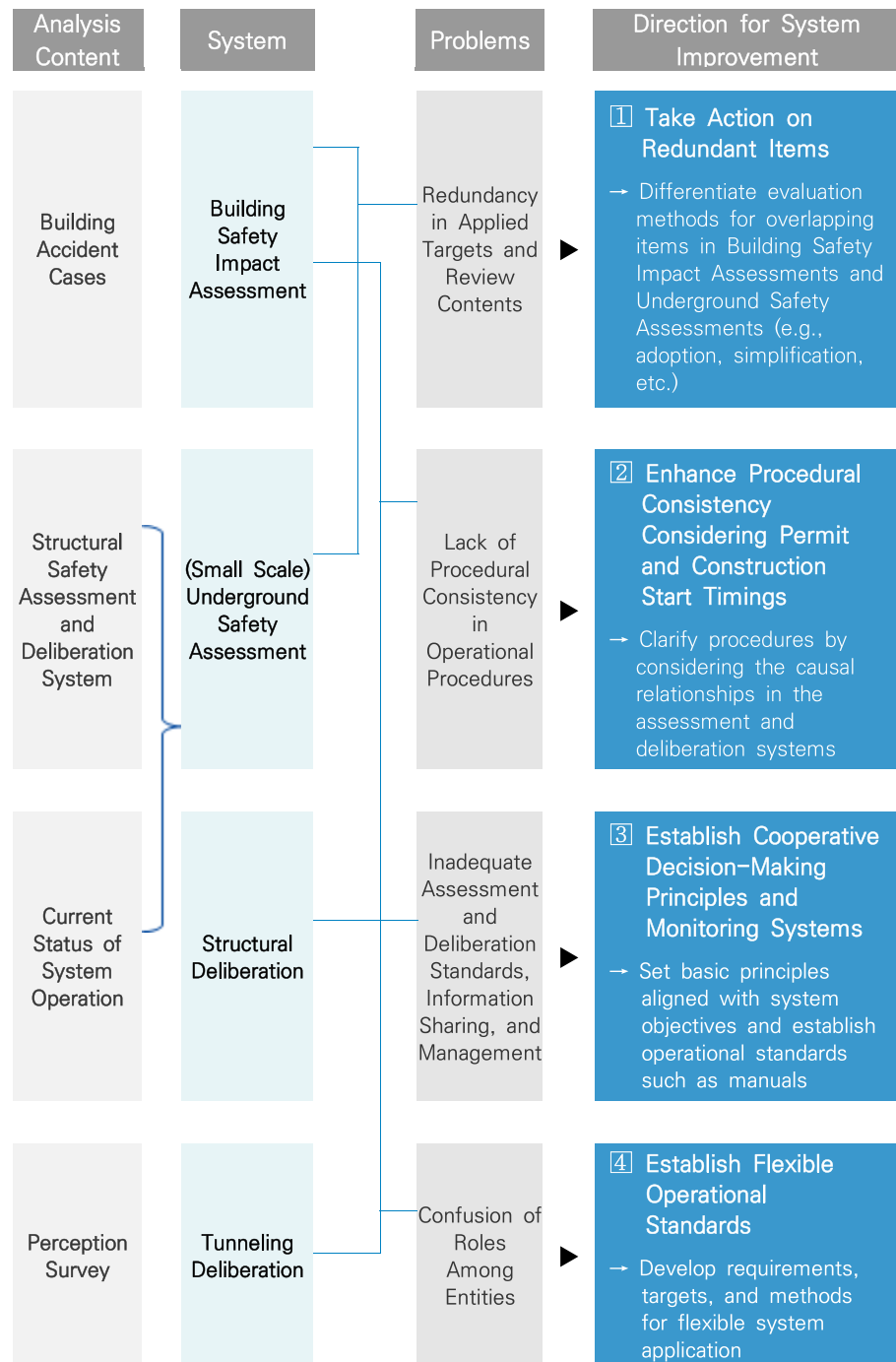
First, we enhance procedural coherence by establishing evaluation and deliberation implementation timelines and document submission requirements and principles, considering the actual design phase and the timing of permits and construction commencement. (Refer to Table 4-2)

Second, through amendments to the Building Act and its Enforcement Decree, we enable flexible operation of the finalization deliberation timing for building safety impact assessments and clearly differentiate it from structural safety reviews. (Refer to Tables 4-3, 4-4, and 4-5)

Third, by revising the Building Act and Building Committee review standards, we establish operational criteria for building safety impact assessment finalization deliberations and distinguish their purpose and direction from structural safety reviews. (Refer to Table 4-6)

Fourth, to integrate similar and overlapping evaluation regulations, we minimize redundant tasks by transferring similar items from building safety impact assessments to underground safety assessments (Refer to Table 4-7) or verifying building safety impact assessment results within underground safety assessments. (Refer to Table 4-8)

Fifth, we digitize administrative processes for evaluation and deliberation procedures and results. We link the architectural administration system to allow access to evaluation and deliberation status information. (Refer to Table 4-10)



[Directions for Improving Safety Assessment and Deliberation Systems in the Building Design Process]

Source: Compiled by the Research Team

System Improvement Direction	Consolidation and Maintenance of Similar and Overlapping Evaluation Regulations	
Derivation of System Improvement Tasks	Transfer Similar Ground Items from Building Safety Impact Assessment to Underground Safety Assessment	<p>(Plan 1) Focus the Building Safety Impact Assessment on the design of permanent structural elements such as foundations and transfer items related to the adequacy of retaining wall design, ground settlement due to excavation, and groundwater impact analysis to the Underground Safety Assessment.</p> <p>(Plan 2) Mandate the confirmation of evaluation results and their incorporation in the detailed design phase Underground Safety Assessment and Tunneling Deliberation for items related to groundwater changes and ground stability investigations due to excavation work.</p>
	Introduce Special Provisions for Construction Projects in the “Special Act on Underground Safety Management” to Relax or Presume the Application of Underground Safety Assessments	Establish clauses regarding the confirmation and deliberation of assessment results when the Underground Safety Assessment is conducted before soil, foundation, and tunneling-related deliberations
	Amend the Building Committee Deliberation Standards to Present Operational Principles for Local Government Specialized Committees (soil, foundation, tunneling, etc.) and Underground Safety Assessments	Develop criteria for confirming and deliberating assessment results when the Underground Safety Assessment is implemented before soil, foundation, and tunneling-related deliberations

[Summary of System Improvement Tasks – 1]

Source: Compiled by the Research Team

System Improvement Direction	Enhancing Procedural Consistency for Evaluation and Deliberation Considering Permit and Construction Start Timings	
	Establishing Flexible Operational Standards	

Derivation of System Improvement Tasks	Revise Evaluation and Deliberation Document Criteria and Newly Establish Operational Regulations	Establish operational standards for Building Safety Impact Assessment and final deliberation under the "Building Act"
		<ul style="list-style-type: none"> Remove the mandatory requirement to incorporate Building Safety Impact Assessment results when applying for building permits and introduce conditional clauses that allow flexible adjustment of the timing of final deliberations to before the commencement of construction.

System Improvement Direction	Establishing Cooperative Decision-Making Principles and Monitoring Systems	

Derivation of System Improvement Tasks	Establish Administrative Computerization Regulations for Assessment and Deliberation Procedures and Results	Incorporate into the administrative computer system that allows viewing of assessment and deliberation status information
		<ul style="list-style-type: none"> Integrate information so that the Building Administration System's information disclosure service enables the querying of building safety impact assessments, underground safety assessments, and their progress status during permit information and deliberation processes.

[Summary of System Improvement Tasks – 2]

Source: Compiled by the Research Team

As a basic study to improve the structural safety assessment and verification system in the building design process, this study has the following limitations and future research issues.

Due to limited access to data, only limited case analysis was conducted. In the future, it is necessary to expand the scope of case collection and conduct in-depth analysis.

Building design process and safety verification:

This study has identified areas for improvement in the building design process and construction safety management. Further discussion is needed to evaluate and verify the safety of the building production process.

To improve the system, we must prepare a strategy and plan, considering opinions and the effectiveness of streamlining regulatory operations. We propose short-, medium- and long-term strategies and plans, considering limitations, acceptability, difficulty and time.

Near-term improvements plan (1-2 years)		
Improvement of systems and establishment of standards	Ensure consistency and expertise in the deliberation process	Disclosure of evaluation and deliberation results
Set safety standards for building assessments and inspections. Simplify submissions for efficiency.	Clarify the principles and criteria for structural safety committees.	Publish results to improve access to information and regulator credibility.
Mid-term improvements plan (3-5 years)		
Integrate assessment procedures and build systems	Strengthen local building safety management capabilities	Integrated Safety Assessment
Integrate safety management systems for underground, excavation and building safety.	Strengthening regional building safety centres.	Unify the Construction Committee's decision on specialised institutions.
Long-term improvements plan (5+ years)		
Revise overarching legislation to integrate the system.	Local governments handle evaluation and advisory functions.	Establish a locally-based building safety management system

Source: Compiled by the Research Team

Keywords

Structural Safety, Structural Design, Building Safety Impact Assessment, Underground Safety Assessment, Structural Safety Deliberation, Tunneling Deliberation