

3-A-4-양-13

국외학술발표

BIM Application in Quantitative
Assessment of High-Speed
Information and Communication
Criteria for Building Certification
- ICCEPM 2024 The 10th International
Conference on Construction Engineering and
Project Management -

2024.11.

과 제 명	인공지능 기반의 건축설계 자동화 기술개발		
주 관 기 관	경북대학교 산학협력단		
총 연구 기간	2021. 04 . 01 - 2025. 12 . 31(4년 9개월)		
해당연도(4차년)	2024. 01 . 01 - 2024. 12 . 31(1년)		
구 성 기 술 명	구성기술 3	설계 품질검토 자동화를 위한 지능형 설계서비스 보급·활용 기술개발	
세 부 과 제 명	3-A	지능형 설계적법성 평가 및 건축행정 서비스 지원 기술개발	
공 동 연 구 기 관	경희대학교 산학협력단, (주)코스펙이노랩		
연 구 기 관	경희대학교 산학협력단	연구책임자	김인한



ICCEPM 2024

The 10th International Conference on Construction Engineering and Project Management

How innovative technology shapes sustainable built environment beyond limits for research and industry

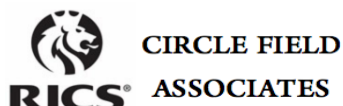


29th July – 1st August 2024

Conference Hall, Hokkaido University
Sapporo, Hokkaido, Japan

Edited by Han Tian, Ph.D., Tamura Atsushi, Ph. D., Nagumo Yosuke, Ph. D. and Jung In Kim, Ph. D.

Conference Sponsors and Supporting Organizations



ICCEPM2024 Sapporo

TECHNICAL PROGRAM PROCEEDINGS

ROOM4 (DAY2&DAY3)

SESSION CODE	SESSION THEME	SESSION CHAIR	ROOM	Theme	DAY	DATE	START	FINISH	Paper Number	Authors	Title
DAY2-SESSION1-ROOM4	4. Visualization, Information Modeling, and Simulation (Digital Twin, AR/VR, BIM)	Zeru Liu /Jung In Kim	ROOM4	4	DAY2	30-Jul-24	10:30	10:45	32	Jongyeon Cho, Jyu Shin and Tawen Ken	A framework for 4D analysis of construction safety using a site information model
			ROOM4	4	DAY2	30-Jul-24	10:45	11:00	42	Haejun Chong and Sung-Ah Kim	Systematic Literature Review of Korean Research for the Integration of VR, AR, and MR Technologies in Construction BIM: An Exploration Across the Construction Lifecycle
			ROOM4	4	DAY2	30-Jul-24	11:00	11:15	47	Muhammad Tajammal Khan	Building Information Model (BIM) and Geotechnical Baseline Report (GBR) for Improving Project Management Tools of Underground Works
			ROOM4	4	DAY2	30-Jul-24	11:15	11:30	49	Qinghao Zeng, Taek Kiha and Paride Pishdad-Bozorgi	A Review of BIM-Enabled Daylighting Control System for Office Buildings
			ROOM4	4	DAY2	30-Jul-24	11:30	11:45	64	Zeru Liu, Wuhao Huang, Hejun Xu, Shing Li and Jung In Kim	FC Data Schema Extension for Railway Track Facility Management
			ROOM4	4	DAY2	30-Jul-24	11:45	12:00	65	Ke Da, Shuhan Yang, Zeru Liu, Jung In Kim and Min Jae Suh	Slope design optimization for road cross section using genetic algorithm based on BIM
			ROOM4	4	DAY2	30-Jul-24	12:00	12:15	56	Minhyuk Jung, Jaemoek Choi, Seonjo Joo, Heekyung Chun and Wonsuok Choi	Neural Network based generative design framework for industrial plant layout planning
DAY2-SESSION2-ROOM4	4. Visualization, Information Modeling, and Simulation (Digital Twin, AR/VR, BIM)	Bongsang Koo	ROOM4	4	DAY2	30-Jul-24	13:15	13:30	73	Shyan Kim, Wookseok Lee, Youngsu Yu, Haen Jeon and Bongsang Koo	Employing Ontology and Machine Learning for Automatic Clash Detection and Classification in Multi-disciplinary BIM Models
			ROOM4	4	DAY2	30-Jul-24	13:30	13:45	75	Jihye Han, Minseo Jang, Do Hyung Shin and Sungwon Woo	Technology for classifying point cloud data through AI and automatically deriving location and length information in 3D space based on scan to bim
			ROOM4	4	DAY2	30-Jul-24	13:45	14:00	86	Kieu Thi Cuong, Shide Kazuya and Nguyen Hoang Tung	LCA calculation methods using BIM at the basic design stage: A focus on matching BOM and CO2 room data using Uniclass and IDEA
			ROOM4	4	DAY2	30-Jul-24	14:00	14:15	110	Kamyar Fotembari, Qinghao Zeng, Ali Tavakoli-Yaraghajaha and Paride Pishdad-Bozorgi	Multi-objective Generative Design based on Outdoor Environmental Factors: An Educational Complex Design Case Study
			ROOM4	4	DAY2	30-Jul-24	14:15	14:30	122	Moosun Park, Inseong Kim, Gulsuk Kim and Seokyoung Won	Establishing an Integrated Control Platform Architecture for Hydrogen Pipe Network
			ROOM4	4	DAY2	30-Jul-24	14:30	14:45	132	Akheem Pedro, Mehrtash Soliani, Rahaf Hussain and Charisk Park	The Metaverse in Construction: Foundations, Frameworks, and Potentials
			ROOM4	4	DAY2	30-Jul-24	14:45	15:00	143	Agda Sabri, Rahat Hussain, Akheem Pedro, Mehrtash Soliani, Dongmin Lee, Charisk Park and Jae-Ho Pyeon	Synthetic Data Generation with Unity 3D and Unreal Engine for Construction Hazardous Scenarios: A Comparative Analysis
DAY2-SESSION3-ROOM4	4. Visualization, Information Modeling, and Simulation (Digital Twin, AR/VR, BIM)	Sung-Jae Bae	ROOM4	4	DAY2	30-Jul-24	15:15	15:30	154	Ali Khoodabakhshi, Jay Woong Park and Unnesa Ray	Applications of Agent-Based Modeling (ABM) in Planning and Design of Built Environments
			ROOM4	4	DAY2	30-Jul-24	15:30	15:45	164	Sung-Jae Bae, Mi-Ji Song, Eunji Choi, Chan-Jin Kim, Jun-beom Park, Young Suk Kim and Jung-Yeol Kim	Point Cloud Segmentation Method Considering Wall Finishing Information Using 2D Material Segmentation and Back Projection
			ROOM4	4	DAY2	30-Jul-24	15:45	16:00	167	Jae-ho Jang, Jin-Bin Im, En-Lian Zhang, Moon-Boo Joo, Shin-Hyun Kang and Ju-Hyung Kim	A Framework for Assessing the Learning Performance and Creativity in Spatial Features by Immersive Virtual Environments
			ROOM4	4	DAY2	30-Jul-24	16:00	16:15	172	Du Li, Huijun Lin Chi and Ying Wang	Enhancing On-Site Construction Machinery Handling through 3D Spatial Gesture-Based Trajectory Interpreter Modeling
			ROOM4	4	DAY2	30-Jul-24	16:15	16:30	199	Chao-Ying Lin and I-Chen Wu	Real-time simulation and control of indoor air exchange volume based on Digital Twin Platform
			ROOM4	4,7	DAY2	30-Jul-24	16:30	16:45	209	Tawon Kim and Inhan Kim	BIM application in Quantitative Assessment of High-Speed Information and Communication Criteria for Building Certification
			ROOM4	4	DAY2	30-Jul-24	16:45	17:00	181	Jae-Wan Park, Wookseok Jang, Seoung Beom Na, Kyung-Ho Chen, Jae-Goo Han and Keung PI Park	Estimation of Overcut and Undercut Volume in Tunnel Construction Project using 3D Model
DAY3-SESSION1-ROOM4	4. Visualization, Information Modeling, and Simulation (Digital Twin, AR/VR, BIM)	I-Chen Wu	ROOM4	4	DAY3	31-Jul-24	10:30	10:45	200	Yen-Min Hsu and I-Chen Wu	Automatic Ductwork BIM Generation System for Analyzing HVAC System Conflicts
			ROOM4	4	DAY3	31-Jul-24	10:45	11:00	214	Sohee Jeong, Dayeon Yang and Geonhee Kim	Importance analysis of BIM utilization by construction management companies
			ROOM4	4	DAY3	31-Jul-24	11:00	11:15	216	Keiveth Park and Sungkoti Moon	Is 3D Scanning and Modeling Beneficial for Housing Sector?
			ROOM4	4	DAY3	31-Jul-24	11:15	11:30	227	Myunghoun Jang and Dongyu Ch	Method to Manage Building Construction Safety Using Photogrammetry
			ROOM4	4	DAY3	31-Jul-24	11:30	11:45	234	Sou Musakami and Kazuya Shide	Proposal of a virtual room using MR technology and research on its effectiveness
			ROOM4	4	DAY3	31-Jul-24	11:45	12:00	254	Dajeong Choi and Choongwan Koo	An Integrated Platform for Assessing the Efficacy of Immersive Virtual Reality Experiences through Biometric Response Analysis
			ROOM4	4	DAY3	31-Jul-24	12:00	12:15	267	Yong-Ju Lee, Linh Nguyen and Man-Woo Park	Superimposing 3D Models on Real Scenes Based on the Reinforcement Learning using Visual Observations
			ROOM4	4	DAY3	31-Jul-24	12:15	12:30	288	Jiahong Cho, Sunggyo Kim, Kanghyuk Lee, Sangun Choi and Sanghyuk Kang	Development of a BIM Object Partitioning System for 4D Simulation in Mixed Reality
			ROOM4	7	DAY3	31-Jul-24	13:15	13:30	58	Keiki Fukumura, Daisuke Nakagawa, Tomohiko Watanabe, Kenji Otsuka, Shunichi Fujii, Daichi Hanikita, Ryoga Otsuka and Kazuya Shide	Proposal for a maintenance management system using point clouds
			ROOM4	7	DAY3	31-Jul-24	13:30	13:45	68	Kyoungjun Jung, Handon Kim, Minjae Lee, Donggeun Oh, Jimin Kim and Hyunsang Jang	Discrepancy between South Korea's ZEB Certification System and its Real Energy Saving Effects: An Empirical Analysis
DAY3-SESSION2-ROOM4	7. Building Science (Energy Modeling, Facility Management)	Ryoyu Tanaka / Kosei Ishida	ROOM4	7	DAY3	31-Jul-24	13:45	14:00	70	Ryoyu Tanaka and Kosei Ishida	CREATION OF A BIM-BASED FACILITY MAINTENANCE AND MANAGEMENT DATA ANALYSIS PLATFORM
			ROOM4	7	DAY3	31-Jul-24	14:00	14:15	153	Dagim Derese Gebremichael, Zhenhai Jin, Yunsuub Lee and Youngsoo Jung	Facility Asset Management (FAM) Business Function from the Context of Smart Buildings (SBs)
			ROOM4	7	DAY3	31-Jul-24	14:15	14:30	160	Zhenhai Jin, Dagim Derese Gebremichael, Seunghee Kang, Yunsuub Lee and Youngsoo Jung	Exploring the Functional Breakdown Structure (FBS) of Facility Asset Management (FAM) for Smart Factories
			ROOM4	7	DAY3	31-Jul-24	14:30	14:45	279	Minho Kim, San Jin, Ahmin Jang, Beungyong Park and Sung Lok Do	Simulated Analysis on Cooling System Performance Influenced by Faults Occurred in Entropy Sensor for Economizer Control
			ROOM4	7	DAY3	31-Jul-24	14:45	15:00	283	Ahmin Jang, San Jin, Minho Kim, Beungyong Park and Sung Lok Do	Evaluation of Cooling Energy Consumption Varying Economizer Control and Heat Generation Rates from IT Equipment in Data Center
			ROOM4	7	DAY3	31-Jul-24	15:00	15:15	291	Minji Baik, Hyunsang Cho, Doyoung Lee, Jeonghwan Seo, Hyunsang Jang and Jimin Kim	Analysis of Optimal Placement Proposal of HVAC System in Smart Greenhouse using CFD Simulation

	Enhancing Construction Safety Through Wearable Technology – A Study of Employee Acceptance and Adoption in the USSACE <i>Karen Carnago, Junshan Liu and Scott Kramer</i>	871
	A Conceptual Blockchain and Token-Incentive Approach for Near Miss Reporting in Construction <i>Eric Joshua Nyato, Chansik Park, Dongmin Lee and Emmanuel C Kimito</i>	879
	Comparative Analysis of Construction Safety Culture in Australia and China: A Systematic Literature Review <i>Yiqin Yu, Yao Wang, Wenqi Li, Yuecheng Huang and Dongping Fang</i>	886
	Challenges And Improvement Methods for Monitoring Workload of Construction Workers Through EEG <i>Yuting Zhang and Jiayu Chen</i>	894
	An On-Site and Off-Site Collaborative Safety Monitoring Framework Using Augmented and Virtual Reality for Near-Miss Incidents <i>Thai-Hoa Le and Jacob J. Lin</i>	901
	Challenges For Implementing Smart Construction in Korean Construction Industry Using Micmac-Ism Approach <i>Junhak Lee, Jinwoo Won and Seung H. Han</i>	909
	Assessing Multiple Hazard Recognition Abilities of Construction Equipment Operators in Dark Environments Using Virtual Reality <i>Sangkil Song, Juwon Hong, Jinwoo Choi, Minjin Kong, Jongbaek An, Jaewoon Jeoung and Taehoon Hong</i>	917
	Enhancing Program Risk Management: A Social Network Approach <i>Wenxin Shen, Xiaofan Zhai and Jingjie Xiong</i>	924
VII.	BUILDING SCIENCE (ENERGY MODELLING, FACILITY MANAGEMENT)	932
	Proposal For a Maintenance Management System Using Point Clouds <i>Keiki Fukumura, Daisuke Nakagawa, Tomohiko Watanabe, Kenji Otsuka, Shunshi Fujii, Daichi Hashiba, Ryuga Otsuka and Kazuya Shide</i>	933
	Creation of a BIM-Based Facility Maintenance and Management Data Analysis Platform <i>Ryoyu Tanaka and Kosei Ishida</i>	941
	Improving Efficiency of University Campus Facility Management Using Digital Twin <i>Shuhei Tazawa, Yui Sato, Stephanie Bay, Yoko Nagayama and Jun Inoue</i>	949
	Exploring The Functional Breakdown Structure (FBS) Of Facility Asset Management (Fam) For Smart Factories <i>Zhenhui Jin, Dagem Derese Gebremichael, Seunghee Kang, Yunsub Lee and Youngsoo Jung</i>	957
	Mixed-Input Neural Networks for Daylight Prediction <i>Thanh Luan Le and Sung-Ah Kim</i>	965
	BIM Application in Quantitative Assessment of High-Speed Information and Communication Criteria for Building Certification <i>Taewon Kim and Inhan Kim</i>	972

BIM application in Quantitative Assessment of High-Speed Information and Communication Criteria for Building Certification

Taewon KIM ^{1,*}, Inhan KIM ^{2,#}

¹*Department of Architecture, Kyung Hee University, Korea, E-mail address: gopeterpango@khu.ac.kr*

²*Department of Architecture, Kyung Hee University, Korea, E-mail address: ihkim@khu.ac.kr*

Abstract: As buildings become increasingly diverse in size and type, a continuous process of generating and processing various information within these structures occurs. This process is being addressed with the advancement of high-speed information and communication technology, which is being extensively applied in buildings. Such changes are institutionalized through the certification of high-speed information and communication buildings. This certification is crucial for ensuring the quality and connectivity of the essential communication infrastructure in modern buildings. Building Information Modeling (BIM) has established itself as an effective tool for the integrated management of design, construction, and operation in architectural projects. This research aims to refine and categorize the evaluation criteria suitable for the building certification based on high-speed information and communication criteria and to explore the applicability of BIM tools based on these criteria. By enhancing the substitution and connection of each library, the functionalities of BIM programs for a comprehensive review of information and communication facilities are expected to be applied in a more utilitarian direction.

Key words: Ultra-high-speed information and communication technology, Building certificate regulation, Building Information Modeling (BIM), BIM Libraries

1. INTRODUCTION

As the forms and functions of buildings become more diverse, information and communication technology (ICT) is increasingly utilized within these structures. Buildings that integrally use ICT services in areas such as structure, facilities, electrical systems, and fire safety are defined as high-speed information and communication buildings. The architectural field has shown interest in high-speed ICT buildings, leading to the establishment of a certification system in April 1999, with the certification process commencing in May 1999[1]. Since August 2009, certification review tasks have been ongoing. This certification of high-speed information and communication buildings contributes to the advancement of internal communication networks and the widespread distribution of high-speed internet, alleviating bottlenecks in high-speed communication networks[1]. It is expected to play a leading role in laying the foundation capable of fully accommodating future advanced ICT services. High-speed ICT buildings are characterized by the need to process and recover large amounts of information quickly and efficiently, especially in disaster or emergency situations[2]. The unique technology of compiling and processing massive amounts of information is also present in Building Information Modeling (BIM), which combines information from various facilities such as fire safety, facilities, electrical systems, and structure into a unified 3D model. This study aims to integrate high-speed information and communication building certification with BIM tools. BIM plays a crucial role in supporting decision-making during the design, construction, and operation phases by digitally representing the physical and functional characteristics of buildings. As the importance of ICT and BIM

in the architectural field increases, their efficient integration holds the potential to innovate the design, construction, and operation of buildings. However, the current high-speed information and communication certification standards do not adequately consider integration with BIM, limiting the optimization of ICT functionalities in building management through BIM. This research analyzes the possibilities of integrating high-speed information and communication certification with BIM programs to explore ways to improve the information management and communication functions of buildings from design to maintenance. It focuses on evaluating the integration possibilities between two domains: the analysis of high-speed information and communication certification standards and the use case studies of BIM programs. The proposed integration approach aims to enhance the information and communication functionalities and management efficiency of buildings while promoting the digital transformation of the architectural field and contributing to the development of future-oriented building management and operation strategies.

2. Literature review

S. Jaeyoung, L. Jinkook, 2016 [3] suggest utilizing BIM for automated code compliance checks by detailing the objects and attributes presented in the Korean Building Code. P. Jungwook et al., 2009 [4] analyze the meaning and functionalities of BIM, reviewing domestic and international examples to discuss the proper implementation methods of BIM. They suggest that while BIM may not solve all issues in the architectural field, such as increasing production efficiency and reducing errors, it can be successful when actively adopted for complex, large-scale projects. S. Jongkwan et al., 2013 [5] analyze rules for performing automatic reviews based on BIM models of ductwork facilities. This analysis involves three main steps: first, analyzing the design and construction standards of ductwork to identify review items; second, deriving rules for the review items; and third, applying these rules to BIM models for review. The review items are broadly categorized into shape, placement, connection, insulation, finishing, and others. Through literature review, this study presents a strategic analysis of the evaluation criteria for the certification of high-speed information and communication buildings by analyzing standards and deriving rules for automatic review in ICT facilities, applying them to relevant aspects of BIM information.

3. Research process

The certification system for high-speed information and communication buildings is divided into two categories: the certification for high-speed information and communication buildings and the certification for home networks. As shown in Table 1, there are facilities classified into three categories for high-speed information and communication building certification, and there is home network certification. The high-speed information and communication building certification is divided into three levels: premium grade, first grade, and second grade, while the home network certification is divided into three levels: AAA grade, AA grade, and A grade.[2]

Table 1. Types and Classes of High-Speed Information and Communication Building Certification Facilities[7]

facility	facility	rating
High-Speed Information Communication Building Certification	Apartment house, semi-housing officetel	Special grade, grade 1 and 2
	Business facilities	
	Rowing House, Multi-family House, Dormitory, Urban Living House	
Home Network Authentication	Home network	AAA grade (home IoT), AA grade, and A grade

For each type of facility certification, there are multiple items that are inspected. As seen in Table 2, there is the certification for high-speed information and communication buildings, which includes six review items, and the certification for home networks, which comprises two review items.

Table 2. Types and Classes of High-Speed Information and Communication Building Certification Facilities[8]

type	category
High-Speed Information Communication Building Certification	Wiring facilities
	Central District Communications Office
	Plumbing facilities
	In-house wiring performance
	Drawing Management
Home Network Authentication	Digital broadcasting
	Wiring facilities
	Examination items (1), (2), (3)

The diagram presented in Fig 1 visually represents the methodology for integrating these certifications with BIM programs. The first part begins with the characteristics of high-speed information and communication buildings, focusing on the unique aspects of these buildings and leading to the convergence of high-speed information and communication building certification with BIM tools. Here, the application of BIM tools is tailored to the certification process, utilizing the specificity of BIM. The middle part starts with the analysis of certification review criteria, breaking down the criteria into property classifications such as purpose and precautions. It then moves to the stage of changing the order, reorganizing the information into a more systematic structure, considering purpose, space plus size, and rating. The quantitative analysis simplifies the process by formulating the data, adding symbols, and removing unnecessary elements. The final part illustrates research on the application of BIM programs, translating refined certification criteria into applicable BIM property information, which includes items such as purpose, area, depth, length, number, and space. This information will guide the creation and organization of a comprehensive BIM library, including Component, Room, and Area Families, as well as Project Information. Overall, the methodology diagram depicts a gradual integration of BIM tools starting from the unique characteristics of high-speed information and communication buildings, enhancing the review process and creating an organized BIM library to support all phases of building design, construction, and maintenance.

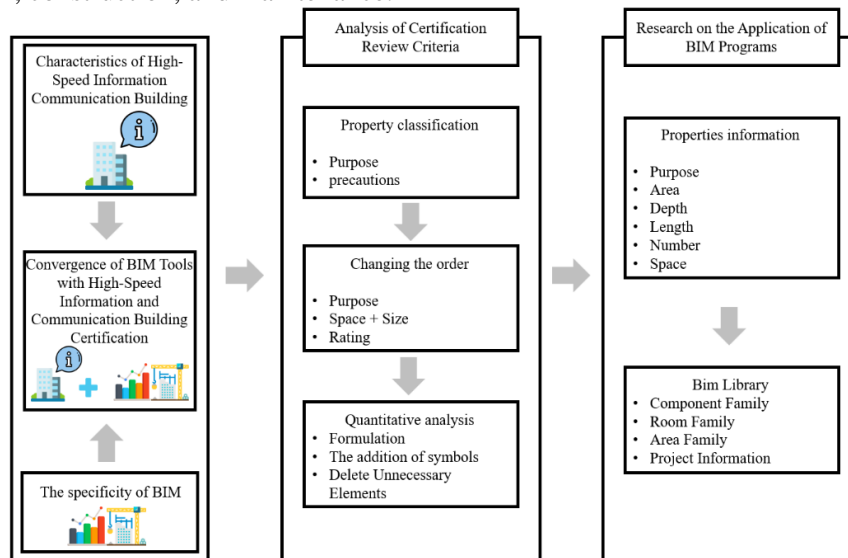


Fig 1. Methodology diagram

3.1. Analysis of Certification System Evaluation Criteria

Among the various review items, the review item for the household terminal box, which pertains to wiring facilities, was analyzed. The terminal box (distribution box) serves as a housing that accommodates terminals for connecting wiring cables to subscriber lead-in wires and is typically installed on utility poles and used as a branching point. The specifications for the types of facilities are restricted. The review items for the household terminal box are indicated in Table 3.

Table 3. Specification requirements for household terminal boxes[9]

facility	rating	criterion
----------	--------	-----------

Apartment, semi-housing officetel	a special grade	mandatory area of 0.2 m ² or more (depth 8 cm or more)
	the first grade	recommended area of 0.2 m ² or more (depth 8 cm or more)
	2 nd grade	300 mm × 300 mm × 80 mm or more size is recommended
Rowing House, Multi-family House, Dormitory, Urban Living	a special grade	300 mm × 300 mm × 80 mm or more recommended installation
	the first grade	
	2 nd grade	

Note 1) Apartments and quasi-housing studio apartments with a special grade and a total floor area of less than 60m² must have a mandatory installation of at least 300mm x 300mm x 80mm.

Note 2) At least one separate power outlet must be secured for the equipment of high-speed internet service providers.

Note 3) The household terminal box should be installed in an exposed location that does not hinder operation and management due to surrounding structures or facilities and is free from the risk of flooding and condensation (excluding shoe cabinets, laundry rooms, verandas, and balconies). However, shoe cabinets are an exception for households with a total floor area of less than 60m².

The specification standards for household terminal boxes can be broadly divided into three categories: first, for apartments and residential-type officetels; second, for row houses, multi-family houses, dormitories, and urban-type living houses; and third, for exceptions, which are outlined in the cautionary notes. To analyze these standards by attribute, they are classified according to use, area, depth, symbols and signs, length and number, conditional statements, space, and grade in Fig 2. The use is marked in red, grade in gray, area in orange, symbols and signs in light green, depth in yellow, conditional statements in sky blue, and space classification in purple, with each attribute assigned a corresponding color.



Fig 2. Attribute Classification

Through the use of color-coding for attributes, the sections pertaining to the use of facilities and cautionary notes are differentiated by colors as shown in Fig 3. In the sentences, the word "or more," which is frequently used, corresponds to symbols and signs, and thus is depicted in light green, while 0.2m², being an area, is represented in orange. In the cautionary notes, additional information regarding the space attribute, which was not previously mentioned, is provided, indicating that a purple classification for space attributes has been applied.

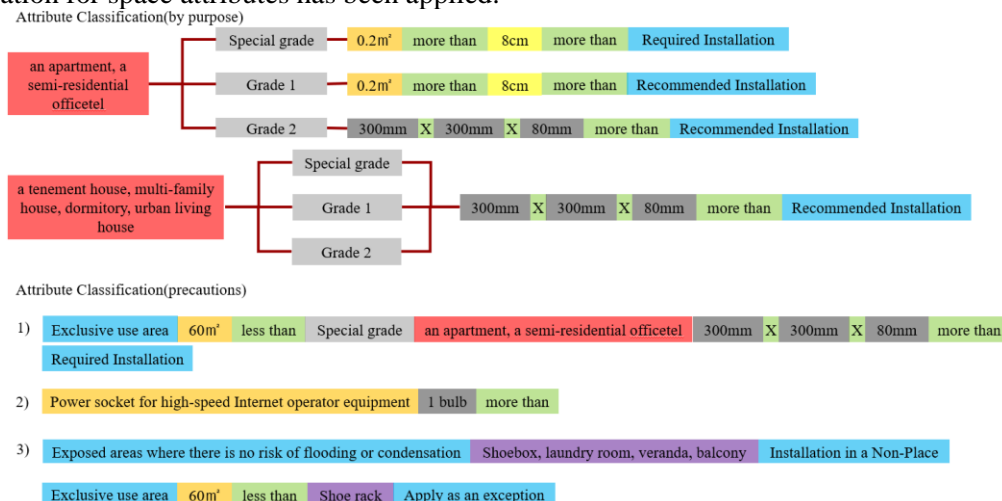


Fig 3. Attribute Classification [facility(fuction), Precautions]

Through the distinction of color attributes, it is possible to identify that sentences in the certification system contain various attribute information. After completing the attribute distinction process, as shown in Fig 4, the order is changed to first position the use and space lines, followed by scale and grade. Before positioning the information on grades, additional symbols such as equal signs are placed, and unnecessary parts are removed in the order modification process.

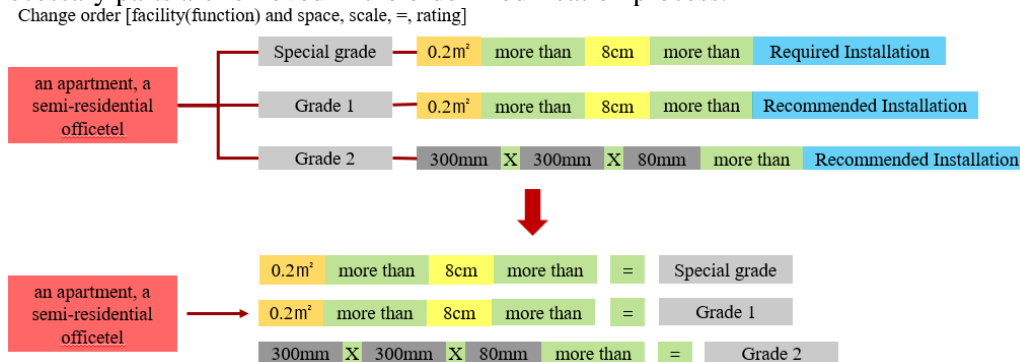


Fig 4. Change order [facility(function) and space, scale, =, rating]

Once the classification of attributes and the change of order are completed, the process proceeds to convert everything into equations except for the characters corresponding to the attributes, as shown in Fig 5. This simplification is achieved through quantification[6], a process of converting into formulas for quantitative analysis. This same process is repeated for other sentences as well, proceeding to quantification[6] as shown in Fig 6. This process is essential as it creates a structure that allows for the quick and efficient verification of items necessary for BIM.

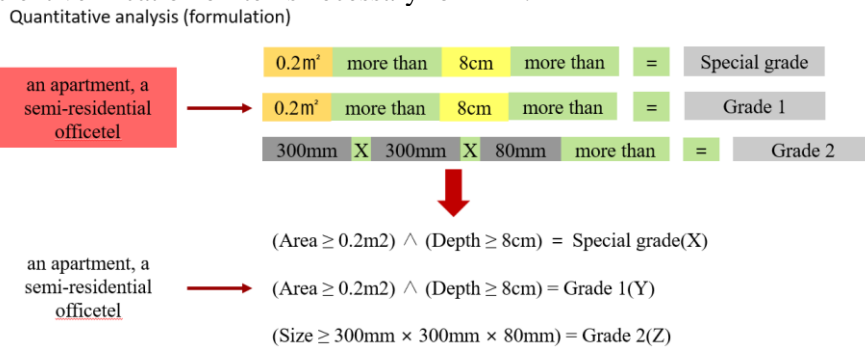


Fig 5. Quantitative analysis (formulation)

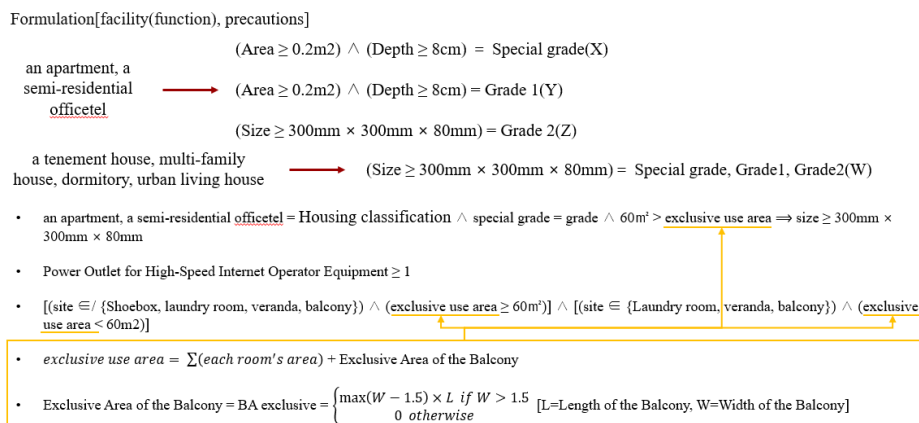


Fig 6. Formulation[facility(function), precautions]

3.2. Research on the Application of BIM Programs

The strategic analysis of the certification review criteria is utilized in the second stage of the study, which involves the application of BIM programs. One such BIM program, REVIT, is used for this purpose. The drawing presented in Fig 7 is a model of a residential space comprising an apartment with five rooms, two bathrooms, one kitchen and dining area, one living room, one entrance hall, and two balconies. To apply the household terminal box in this drawing, the LAN facility_hub_WALL FDF family is utilized. This family is placed in the hallway space near the entrance.



Fig 7. Floor plan and generation junction box library

Using this family, the review process considers only the attributes of use, area, depth, length and number, and space as necessary elements for BIM. Firstly, the BIM information pertaining to use is entered through the project parameters section as shown in Fig 8, and information about the use can be verified through the representative use item in the project information section. Since the current space is an apartment, it can be confirmed that the representative use is also an apartment.

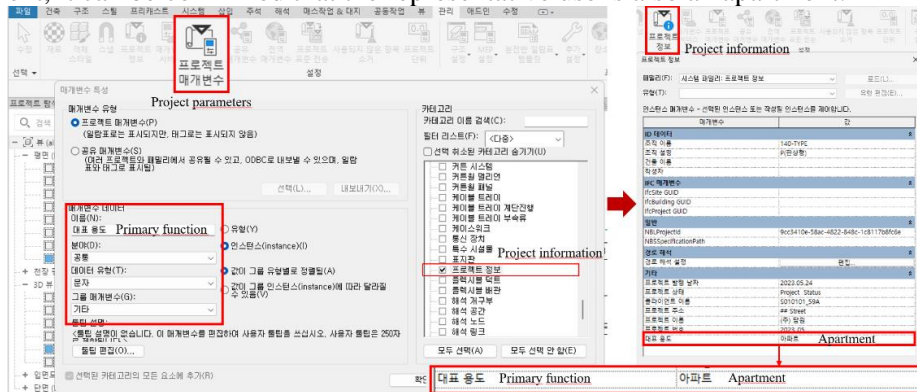


Fig 8. BIM information requirements for building usage details

Secondly, the BIM information pertaining to area, depth, and length can be verified within the household terminal box family as shown in Fig 9 (red). Length requirements can be met through the dimensions of width, depth, and height, and the area requirement can be indirectly met through the multiplication of width and height. The depth requirement can be met through the depth dimension. The area is calculated as width x height = 300mm x 1000mm = 0.3m², satisfying the requirement of ≥0.2m², and the depth of 30cm satisfies the requirement of ≥ 8cm, indicating that it meets the standards for premium grade (X) and first grade (Y). Thirdly, in terms of the requirement for at least one power outlet for high-speed internet service provider equipment, Fig 9 (yellow) can include information on the rated capacity, voltage, and frequency pertaining to power, but it is observed that there is a lack of information regarding the number of such outlets in the family, indicating a data shortfall in the specific equipment section.

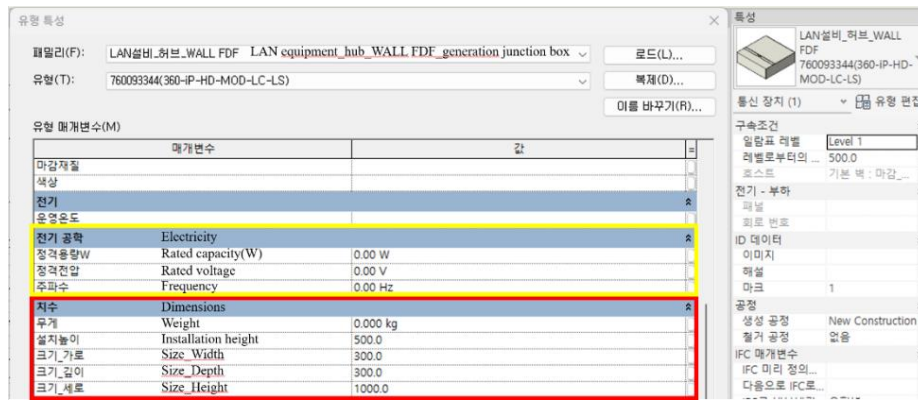


Fig 9. Length, area, depth, quantity, voltage, and frequency

Fourthly, the BIM information regarding the space and the area of that space is indicated in Fig 10. For the space naming, the LAN facility_hub_WALL FDF family, which is the household terminal box family, allows for the connection of space information in the installation location item within the family property information. Space information can also be linked from the room family in the name item located in the ID data section and the space classification item in the miscellaneous section. For the area of the space, information about the area can be linked from the area item within the area family property information. When attempting to calculate the exclusive area of the apartment drawing through Fig 10, the results are as follows. The sum of all spaces, excluding balconies A and B, is 156.8m². In balcony A, an additional area is calculated because the middle part exceeds the minimum width (1.5m), resulting in (2.3m - 1.5m) X 2.3m = 1.84m². Similarly, in balcony B, an additional area is calculated because the middle part also exceeds the minimum width (1.5m), resulting in (1.6m - 1.5m) X 5.3m = 0.53m². Therefore, the exclusive area of this apartment drawing is calculated as 156.8m² + 1.84m² + 0.53m² = 159.17m². Since this is larger than the specified exclusive area of 60m² mentioned in the cautionary notes for the household terminal box, it confirms that installation can be made in places other than the shoe rack, laundry room, veranda, and balconies, such as in the living room area.

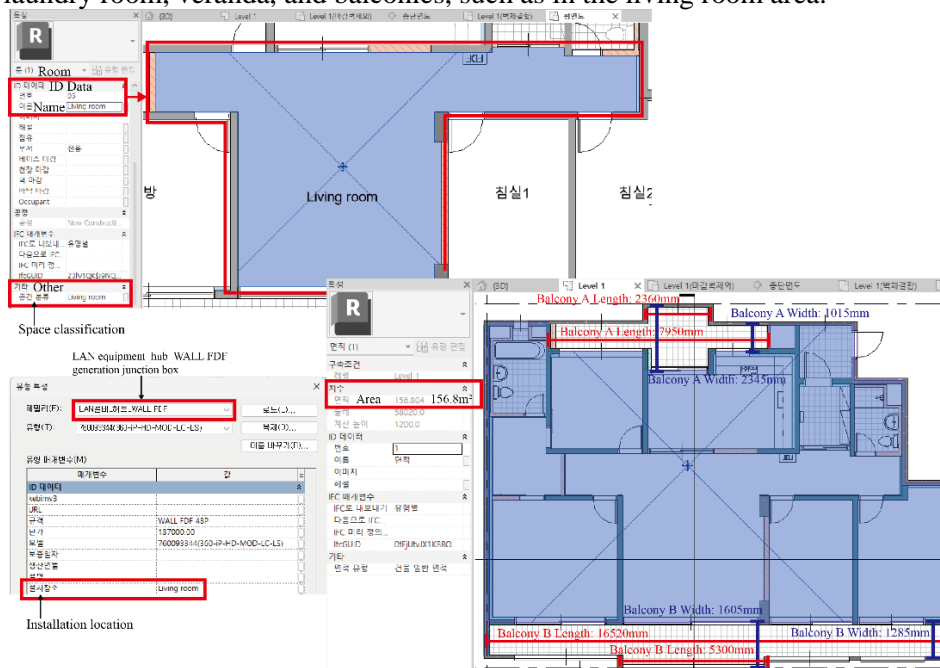


Fig 10. Space and area for each space

4. Conclusion

This research is grounded in the shared characteristics of high-speed information and communication buildings and BIM. It starts with an analysis of the certification review criteria for high-speed

information and communication buildings and progresses through several stages to a strategic analysis that collects the necessary conditions for libraries suitable for each piece of information in BIM programs and compiles numerical data. This allows for an understanding of the review criteria and compatibility with BIM. The study has identified a significant lack of library information related to ICT facilities in BIM and points out the need for improvement of existing libraries(families) and development of missing libraries(families), considering the recent advancements in libraries and ICT-related BIM. Such improvements would strengthen the interconnections and interactions between libraries and enhance the role of BIM in comprehensive ICT facility management. The research has identified gaps in library information to strengthen the interaction between high-speed information and communication buildings and BIM, providing important insights for efficient management of ICT facilities using BIM. It also deepens the understanding of how the development and improvement of BIM libraries can enhance the efficiency and effectiveness of ICT facility management. However, the study has limitations. It focuses on high-speed information and communication buildings in a specific region, requiring caution in generalizing to other regions or building types. The data and analysis used are primarily based on existing literature and technical specifications, and there may be a lack of in-depth analysis of actual application cases in the field. Moreover, the development and integration of BIM libraries is a complex process that requires the participation and collaboration of various stakeholders, yet the study does not address specific strategies for these aspects. Future research could overcome these limitations by exploring the applicability of BIM libraries in various building types and regions, further advancing the integration of BIM and ICT to enhance the efficiency and effectiveness of ICT facility management. Additionally, with new technological advancements and policy changes, there is a need for standardized BIM models and evaluation models that can flexibly respond to these changes, suggesting a system that can review comprehensive information through BIM auxiliary programs is necessary.

ACKNOWLEDGEMENTS

This work is supported in 2024 by the IITP(Institute for Information & Communications Technology Planning & Evaluation) grant funded by the MIST(Ministry of Science and ICT) (Grant RS-2023-00220183, Development of BIM library standards for implementing 3D data modeling of information and communication facilities) and is supported in 2024 by the Korea Agency for Infrastructure Technology Advancement(KAIA) grant funded by the Ministry of Land, Infrastructure and Transport (Grant RS-2021-KA163269).

REFERENCES

- [1] S. TaeSeok, "The Past and Present of the High-Speed Information and Communication Building Certification System," in TTA Journal, No. 103, KT BcN Headquarters, pp. 152-160, 2006.
- [2] N. SangTae, "Introduction to High-Speed Information and Communication Building Certification System," in Facility Journal, Vol. 39, No. 10, pp. 31-38, 2010.
- [3] S. Jaeyoung, L. Jinkook, "Application of Classification of Object-property Represented in Korea Building Act Sentences for BIM-enabled Automated Code Compliance Checking", Korean Journal of Computational Design and Engineering, 21(3), pp.325-333, 2016.
- [4] P. Jungwook, K. Sangchul, L. Sangsoo, S. Hayoung, "Suggesting Solutions when Applying Building Information Modeling (BIM) to the Korean Construction Industry through Case Studies", Journal of the Korea Institute of Building Construction, 9(4), pp.93-102, 2009.
- [5] S. Jongkwan, C. Geunha, J. Kibeom, "A Study on the Rule Development for BIM-based Automatic Checking in a Duct System", Korean Journal of Air-Conditioning and Refrigeration Engineering, 25(11), pp.631-639, 2013.
- [6] K. Taewon, K. Dongyoung, K. Inhan, "BIM Data Requirements Analysis for High-Speed Information and Communication Building Certification Evaluation", Proceedings of the Korea CDE Society Winter Conference 2024, 2024.
- [7] <https://www.bica.or.kr/introduce/request.do>
- [8] <https://www.bica.or.kr/standard/house.do>
- [9] <https://www.bica.or.kr/standard/standard.do>