Vision for the Future and Roadmap to BIM

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BIM Promotion Roundtable | 2019.9 | Japan





Ministry of Land, Infrastructure, Transport and Tourism

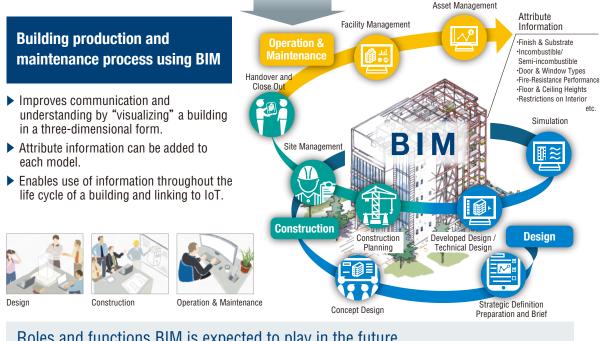
BIM (Building Information Modelling) is...

a system which builds a structure's information model to include not only three-dimensional form information created with a computer but also room names and areas, the specifications and performance of materials and components, and the building attribute information.

Current mainstream (CAD)

- > Drawings are created individually. Floor plan, elevations, sections/structural drawings/mechanical and electrical drawings
- Attribute information for walls, equipment, etc. is linked to drawings in an analog way.
- Design information is seldom used after construction.





Roles and functions BIM is expected to play in the future

cvcle



- productivity through design process reform, etc.
- process and maintenance of buildings Consistent utilization throughout the life
- AI

Visions of a Future Enabled by Utilization of BIM

Realization of high-quality and high-precision building production and operation & maintenance

High Quality



- Images can be shared even with non-architectural professionals by means of reviewing spaces using 3D models and attribute information
- Efficient quality management of architectural production can be realized by centrally controlling the design and construction information
- Optimal operation & maintenance, asset management, and energy management are supported by the data that can be continuously used after project completion

Realization of highly efficient life cycle use

Efficient and Quick



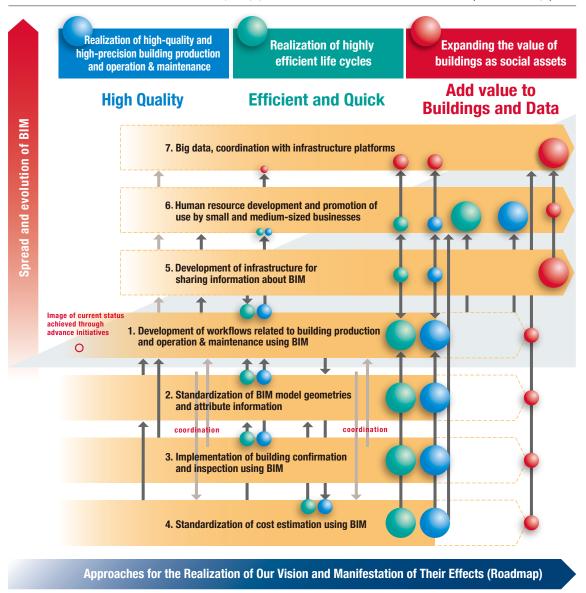
- Quick decision making through visualization of cost effectiveness (cost management)
- Efficient building life cycle use is achieved through smooth communication of information during the design, construction, and operation & maintenance stages
- Streamlining of work in each design and construction process
- Reduce labor costs for operation & maintenance
- Establishment of BIM as a common ground to share and compete internationally

Expanding the value of buildings as social assets



- Realization of appropriate and real-time asset evaluation and management
- Expansion of services for buildings through coordination with centers, etc.
- Creation of new industries with buildings as their origin through the use of big data and AI
- Realization of optimal risk management through integration with infrastructural platforms

Vision for BIM and Necessary Approaches for Its Realization (Roadmap)



* The size of the ball indicates onset of effect expected at the time of attainment.

Basic Strategies for Realization of Future Images

In order to realize the future images of BIM, the construction industry shall proceed with efforts relevant to the development of an environment for BIM utilization in accordance with the following policies.



Process for Realizing the Vision for BIM

Realization of high-quality and	high-precisio	on architectu	ural produc	tion and opera	ation &	maintenance
BIM Utilization Steps	Use	BIM		ch agent uses I collaboratively) c	oordination with AI & IoT
Images can be shared even with 3D model geometries and attribution			onals by rev	iewing spaces	using	
Facilitating consensus building and decision making	Decision making	based on models		Facilitating decision ma and cos	king based o t manageme	
Developing optimal plans through various simulations, etc.	Application to simulations		Complex simul	ations		Complex simulations in conjunction with Al
Visualizing construction schedules and procedures	Visualization construct			hedule forecasting and propos n process based on precedent		Advanced construction schedule forecasting using Al
The efficient quality management design and construction information	nt of architectu tion.	Iral productio	n can be rea	alized by centra	lly cont	rolling
Visualizing cost information	Quick cost estimate	More a	ccurate and faster	cost estimate		Cost estimate forecasting by Al
Ensuring consistency among design, structure, MEP systems, and operation & maintenance		iscrepancies in scipline	>			es in building intenance processes
Improving traceability of MEP systems and components, developing products in accordance with needs			laboration between aanufacturers, etc.	Integrated manag manufactu		ling Automated management and feedback using IoT
Improving accuracy of and visualizing various tests and inspections	Testing and in BIM + 2D	spection using drawings	Testing an	d inspection using BIM		Testing and inspection support by Al
Optimal operation & maintenand that can be used after project co		gement, and	energy man	agement are su	pported	by data
Promoting paperless handling of operation & maintenance documents			Realiz	ing paperless handling o	of operation	& maintenance documents
Developing and operating optimal mid-to-long term repair plans	Repair plans b	ased on past data	Introdu	ction of real-time data		Repair forecast by Al
Optimizing asset management			lized management sset information	Quick grasp of asset value		Asset management based on value fluctuation prediction by Al
Upgrading security		absence of bl	of the presence or lind spots caused re arrangement	Control of accessi gait auther		ng Terrorism and other behavior prediction and warning
Optimizing thermal environment linked to MEP systems		The	ermal environment forecasting	Environmental based on me		Realization of an optimal environment for each person
Image of current status achieved thro	ough advance initiativ	ves Small Mediu	um Large Sm	all, medium, and larg	e qualitativ	ely express the effect of each item.
Realization of highly efficient l	ife cycle					
			- Fa	ah agant ucas		
BIM Utilization Steps	Use	BIM		ch agent uses I collaboratively) c	oordination with AI & IoT
Quick decision making through	visualization o	f cost effectiv	veness (cost	management)		
Facilitating consensus building and decision making (stated again)	Decision making	based on models	<u>}</u>	Facilitating de various simulatior		
Developing optimal plans through various simulations, etc. (stated again)	Application to simulations	Comple	x simulations	Co	omplex simu	lations in conjunction with Al
Visualizing cost information (stated again)	Quick cost estimate	More a	ccurate and faster	cost estimate		Cost estimate forecasting by Al
Faster, less labor intensive asset evaluation of individual buildings			Asset forecasting based on past data	Advanced forecastin actual performa		Earnings optimization by Al
Efficient building life cycle use i construction, and operation & m			communica	tion of informa	tion dur	ing the design,
Reducing rework during production (ensuring consistency between disciplines, labor saving for interference check)	Reduction of discrepa	ancies in each proces	s	Elimination of discrepa operation &		
Optimizing manufacturing of components, systems, etc.	Production adju on expecte	ustment based ed demand		n revenue by combining emand and cost		Strategic manufacturing using Al
Increasing efficiency during repairs and renovations	Labor saved in existing cire			aved in understanding ging building informatio	n >	Support for optimal renovation plans using Al

Realization of highly efficient life cycle								
BIM Utilization Steps	Use BIM	Each agent uses BIM collaboratively	Coordination with AI & IoT					
Streamlining of work in each desi	an and construction pr	ocess						

Streamlining programming and planning	Various simulations reduce labor costs on comparative review	Planning based on life cycle costs	Support for optimal planning by Al
Streamlining design work	Easier detection process of drawing discrepancies/object clash reduces labor cost	Increase efficiency with centralized information management. Progress in prefabrication.	Design support by AI that responds to needs
Optimizing construction plan	Simulate construction and temporary construction	Simulate components loading and timing	Develop optimal construction plans using Al
Promoting efficiency in construction		f construction support technology. ogress in prefabrication.	Automated construction (robots, 3D printers, etc.)

Labor costs reduced on operation & maintenance

Promoting paperless handling of operation & maintenance documents (stated again)		Realizing paperless handling of operation & maintenance documents				
Reducing labor costs with automation of cleaning work, etc.		Partially automated cleaning	Realization of fully automated cleaning			
Reducing labor costs with automation of inspection work, etc.		Partially automated inspection	Realization of fully automated daily inspection			
Optimizing prevention and maintenance		Sensors detect damage	Preventive maintenance by Al			
Image of current status achieved through advance init	iatives Small Medium	Large Small, medium, and large g	ualitatively express the effect of each item.			

Expanding the value of buildings as social assets

BIM Utilization Steps	Use BIM	Each agent uses BIM collaboratively	Coordination with AI & IoT

Realization of appropriate and real-time asset evaluation and management

Faster, less labor intensive asset evaluation of individual buildings	Faster assessment of information necessary for asset evaluation Realization of real-time asset assessment Asset value forecasting by AI	recasting by Al
Optimizing asset management (stated again)	Centralized management Ouick grasp of Asset management based on value fluctuation prediction by Al	
Synergy with town development	Consensus building support using simulation Consensus building support based Forecasting by Al	recasting by Al

Expansion of services for buildings through coordination with centers, etc.

Commercialization of building utilization information			Information storage and sales by sensors	λ	Optimizing buyer selection using AI
Application of latest technologies to buildings	VR, AR, etc.	Damage co	ontrol of buildings based on actual data		Advanced disaster-proof buildings using Al
Optimizing prevention and maintenance (stated again)			Damage detection by sensors	Σ	Preventive maintenance by Al

Creation of new industries with buildings as their origin through the use of big data and Al

Commercialization of building	Commercialization of building production and	Commercialization of building
utilization information	operation & maintenance information	utilization information

Realization of optimal risk management through integration with infrastructural platforms

Linking infrastructure information and buildings	Coordinating information regarding flows of humans and goods inside and outside buildings	Optimizing flows of humans and goods using Al
Realization of sophisticated simulations at a city level	Trial of digital "twin cities"	Creation of digital "twin cities"

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Development of Workflows Related to Building Production and Operation & Maintenance Using BIM

By sorting out "BIM models and extent of information <scope, level of detail>" required at each stage of design, construction, operation & maintenance, and repair, and by clarifying the roles and responsibilities in each process accordingly, the environment for enabling the consistent use of BIM in the building production and operation & maintenance processes will be improved. Main committee members: MLIT + relevant organizations

Establish a workflow from programming through design, construction, and management, and sort out BIM model geometries and the extent of BIM standard guidelines Investi 1-1. (BIM workflow) gation attribute information (standard format) required at each stage. Development of BEP Develop a template with the necessary preliminary arrangements for using BIM in projects (BIM Execution Plan) 1-2 gation standards Development of EIR (BIM Develop a template to define the criteria for an employer gation 1-3. Employer's Information to manage the preparation of project information. Requirements) standards Define BIM models and information contents to be transferred Completion model definition Investi gation nentation 1-4 to operation & maintenance managers after completion. Imp Sort out appropriate relationships with parts manufacturers Sorting out relationships 1-5. gation using BIM data at each stage of the workflow. with parts manufacturers Define the responsibilities for each party according to their roles, and prepare contract standards for BIM based design and construction Contracts for projects 1-6. gation using BIM Sort out remuneration for work related to design and 1-7. Ideal remuneration for work gatior construction, etc. using BIM. Sort out the relationships regarding copyright in building production and operation & maintenance using BIM. Copyright 1-8. gation

> 2. Standardization of BIM model geometries and attribute information, 3. Implementation of building confirmation and inspection using BIM, 4. Standardization of cost estimation using BIM



Standardization of BIM Model Geometries and Attribute Information

By standardizing the modeling (geometry) methods, objects, attribute information items, and attribute information input methods for occasions of BIM creation (such as design, construction, and handover), an environment wherein BIM is used consistently in the production process may be developed. At the same time, cooperation with manufacturers of building materials, structures, and MEP systems will be promoted.

Main committee members: Building Information modeling Library Collaborative research association of Japan + relevant organizations

Item to Consider		Summary		Proce	ess 1	Proc	ess 2	Process 3
2-1.	Object standards	Present basic BIM model creation and display methods.		Investi gation		Trial	2	Implementation
2-2.	Standardization of attribute information	Present information items to be added to BIM and standard input methods.		Investi gation		Trial		Implementation
2-3.	Object library	Create generic objects that are not produced by specific manufacturers and publish them along with the manufacturers' objects.		Trial				Implementation
2-4.	Manufacturers' objects	Make objects created by manufacturers of MEP systems, etc. available in libraries.		Investi gation		Trial		Implementation
2-5.	Coordination between libraries and specification information	In order to make consistent use of information, link BIM information with construction-related specification information (including standard specifications and construction procedures).		Investi gation Practi		tice and Trial		Implementation
		·						

4-1. Development of classification systems

1. Development of workflows related to building production and operation & maintenance using BIM

Implementation of Building Confirmation and Inspection Using BIM

The method of using 2D drawings generated from BIM will be improved to carry out more efficient and accurate building confirmation and inspection using BIM and attribute information. Further, BIM review and inspection as well as coordination with AI and IoT devices will be examined and practiced for more advanced utilization.

Main committee members: Meeting for promotion of BIM utilization in building confirmation + relevant organizations

ltem t	o Consider	Summary	Proce	ss 1	Process 2	2 Process 3
3-1.	BIM 2D review	Develop a method for creating 2D drawings from BIM models and conduct review using BIM + 2D drawings.	Investi gation	Trial	, I	mplementation
3-2.	Viewer	Define the specifications of viewer software for conducting the review using BIM and proceed with its development.	Investi gation		Trial	Implementation
3-3.	BIM review	Carry out confirmation and inspection of building using BIM models (develop related laws and regulations in conjunction).		Investi gation		Implementation
3-4.	BIM inspection	Conduct interim and final inspection of building using BIM models.		Investi gation		Implementation
3-5.	Al review and inspection	Examine digitalization methods for building confirmation information, conduct more efficient building confirmation using Al and more efficient interim and final inspection using IoT devices.			Investi gation	Trial Imple mentation

2. Standardization of BIM model geometries and attribute information



Standardization of Cost Estimate Using BIM

To be able to calculate quantities for a cost estimate from geometries and attribute information using BIM, coding that can centrally manage the components, parts, MEP systems, etc. of a building will be developed, and standardization of cost estimation methods based on each object suitable to BIM will be attempted.

Main committee members: Building Surveyor's Institute of Japan + relevant organizations

ltem t	o Consider	Summary		Proc	ess	s 1	Proce	ss 2	Process 3
4-1.	Development of classification systems	Develop a classification system for building components, parts, systems, operations, etc.					Imple	mentation	
4-2.	Standardization of cost estimate methods		Establish an estimation method using geometry information and attribute information using BIM.				Trial		Implementation
4-3.	Establishment of cost management methods		Establish a new cost management method for building production taking advantage of BIM's characteristics.			Investi gation	Т	rial	Implementation
2. Standardization of BIM model geometries 1. Development of work and attribute information building production a									



Development of infrastructure for sharing information about BIM

Data distribution and storage methods based on international standards and norms will be established to facilitate data coordination between related parties, and an information sharing environment that allows BIM data to be used even after a long period of time will be developed. At the same time, technologies to ensure the reliability of BIM data itself including data authentication, security, and digital certification will be developed.

Main committee members: buildingSMART Japan + relevant organizations

Item to	Consider	Summary	Process 1	Process 2	Process 3
5-1.	Promotion of understanding about international standards and norms	Establish a method to promote understanding through policies to support international standards and norms for BIM data in Japan and easy-to-understand explanations, etc.	Investi gation T	ial	Implementation
5-2.	Establishment of data coordination methods	Analyze and organize information transmitted between the parties involved in the building production process, and establish data coordination processes and methods.	-> Investigation	Trial	Implementation
5-3.	Development of data information sharing infrastructure	In order to effectively utilize a BIM database and platform functions, establish an environment for storing BIM data and sharing information (CDE, or Common Data Environment).	-> Investigation	Trial	Implementation
5-4.	Development of data authentication technologies	Develop technologies to prevent spoofing and falsification to ensure the reliability of BIM data.	-> Investigation	Trial	Implementation
5-5.	Development of digital certification technologies	Develop technologies and methods for BIM based approval and confirmation processes.	Investigation	Trial	Implementation

2. Standardization of BIM model geometries and attribute information

& maintenance using BIM



Human Resource Development and Promotion of Use by Small and Medium-Sized Businesses

In addition to improving the efficiency of building production and operation & maintenance using BIM, BIM managers, technical qualification systems, and human resource development will be promoted so that small and medium-sized businesses can introduce BIM smoothly. Main committee members: buildingSMART Japan + relevant organizations

Item to	o Consider	Summary	Process 1		Process 2	Process 3
6-1.	BIM manager (tentative title)	"BIM Manager (tentative title)" qualification for centrally managing BIM data in the overall building production process	Investigation		Imple	mentation
6-2.	BIM technician qualifications	Technician qualifications related to the creation of BIM data			Implementation	
6-3.	BIM seminars and training	Develop and implement seminars and training methods for introducing BIM in accordance with a common foundation.		Trial		Implementation

1. Development of workflows related to building production and operation & maintenance using BIM 2. Standardization of BIM model geometries and attribute information, etc.

Big data, Coordination with Infrastructure Platforms

In addition to attempting to link BIM with AI and IoT devices, establish methods for applying BIM to information infrastructure, data storage, etc. so that BIM data itself can be used as a social asset.

Ain committee members: National Institute for Land and Infrastructure Management, Building Research Institute + relevant organizations

Item to Consider		Summary	Process 1	Process 2	Process 3
7-1.	Utilization of BIM as big data	Organize methods for safely converting BIM data into big data for each component, product, and project to facilitate cost management and understanding of asset values.	Investi	gation	Trial Imple mentation
7-2.	Coordination with infrastructure platforms	Verify more advanced simulation of disasters, environment, etc. by adding individual building information to infrastructure platforms.		Investigation	
		5.	Development of infrast	tructure for sharing ir	formation about BIM

** For currently active items, organizations actively involved are listed. For currently inactive items, organizations expected to be actively involved are listed.

Investigation Organization for BIM Promotion Roundtable

Advisory pa	anel		
[Chairperson]	Shuichi Matsumura Hirotake Kanisawa Kazuya Shide Tsuyoshi Seike Koichi Yasuda	Project Professor at Department of Architecture School of Engineering University of Tokyo Professor at Shibaura Institute of Technology Department of Architecture and Building Engineering Professor at Shibaura Institute of Technology Department of Architecture and Building Engineering Professor at University of Tokyo Graduate School of Frontier Sciences Professor at School of Environment and Society, Architecture and Building Engineering	
Related Org	ganizations		
Design related organizations		Japan Federation of Architects and Building Engineers Associations, Japan Association of Architectural Firms, Japan Institute of Architects [JIA], Japan Structural Consultants Association [JSCA] Japan Federation of Mechanical & Electrical Consulting firms Association [JAFMEC] (Building Surveyor's Institute of Japan [BSIJ]	
Designated confirmation and inspection organization and Designated administrative agency		Japan Conference of Building Administration [JCBA] Building Center of Japan [BCJ]	
Construction related organizations		Japan Federation of Construction Contractors, National General Contractors Association of Japan, Japan Electrical Construction Association, Air-Conditioning & Plumbing Contractors Associations of Japan	
Management and employer related organizations		Japan Federation of Housing Organizations Japan Facility Management Association [JFMA] Building information modeling Library Collaborative research association of Japan [BLCJ] Real Estate Companies Association of Japan [RECAJ]	
Examination and research organizations		National Institute for Land and Infrastructure Management National Research and Development Agency Building Research Institute buildingSMART Japan [bSJ] Architectural Institute of Japan [AJI]	
Information system and international standards related organizations		Japan Construction Information Center Foundation [JACIC] Institute of International Harmonization for Building and Housing [IIBH]	

Ministry of Land, Infrastructure, Transport and Tourism (MILT) [Secretariat]

Definition of terms

BIM (Building Information Modelling) / A process of constructing a building information model that has not only three-dimensional graphic information created on a computer but also attribute information of the building, such as names and areas of rooms, specifications and performance of materials and members, and finishing.

BIM model / A building information model that has not only three-dimensional graphic information created on a computer but also attribute information of the building, such as names and areas of rooms, specifications and performance of materials and members, and finishing.
 BIM data / The entire information including the 2D rewriting on the BIM in addition to the BIM model.

3D Model / A model that virtually represents a three-dimensional

geometry in a three-dimensional coordinate system of length, width, and height.

2D / A way of representing two-dimensional graphic information using CAD or the like.

■ BEP(BIM Execution Plan) / An arrangement for the design information necessary for using BIM in a specific project. It defines and documents objectives for using BIM, goals, implementation items and their priorities, level of detail (LOD) and accuracy at each stage, information sharing and management methods, an organization for providing services, roles of related parties, system requirements, etc. It is created as a requirements document after being negotiated in advance between the parties involved in the project.

■ EIR (Employer's Information Requirements) / Information requested by an employer in a specific project, including BIM data's level of detail, processes of the project, how to operate the facility after completion, and contractual responsibility matrix.





http://www.mlit.go.jp/jutakukentiku/ kenchikuBIMsuishinkaigi.html * Link to Japanese text only

Materials discussed at the BIM Promotion Roundtable and the Subcommittee for the Development of an Environment for BIM, their minutes, and guidelines related to BIM are available at the URL below.



Architecture and Building Engineering Division, Government Buildings Department, Minister's Secretariat Construction Industry Division, Land Economy and Construction Industries Bureau Building Guidance Division, Housing Bureau

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INFORMATION