Digital Transformation with BIM for Infrastructure in Japan

September 2024

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1. Our current state and BIM

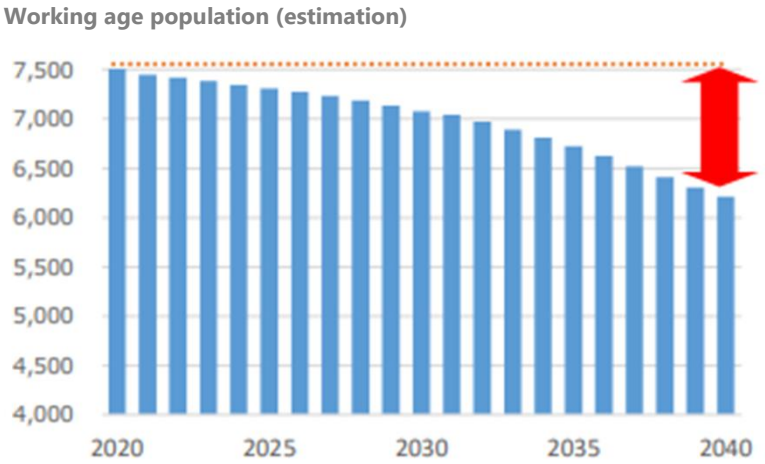
- Our current initiatives in MLIT (i-Construction, BIM)
- Characteristics of our projects in MLIT
- BIM in MLIT (BIM/CIM)
- previous / prospectus directions of BIM/CIM

1.1 Our current initiatives in MLIT (i-Construction, BIM)

the issue we have in the industry…

“ decrease in labor force “

Initiatives to improve productivity…



i-Construction

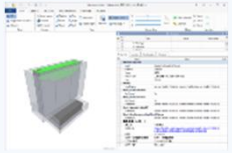
automation around construction sites

i-Construction

BIM

digital data exchange/utilization

3D models



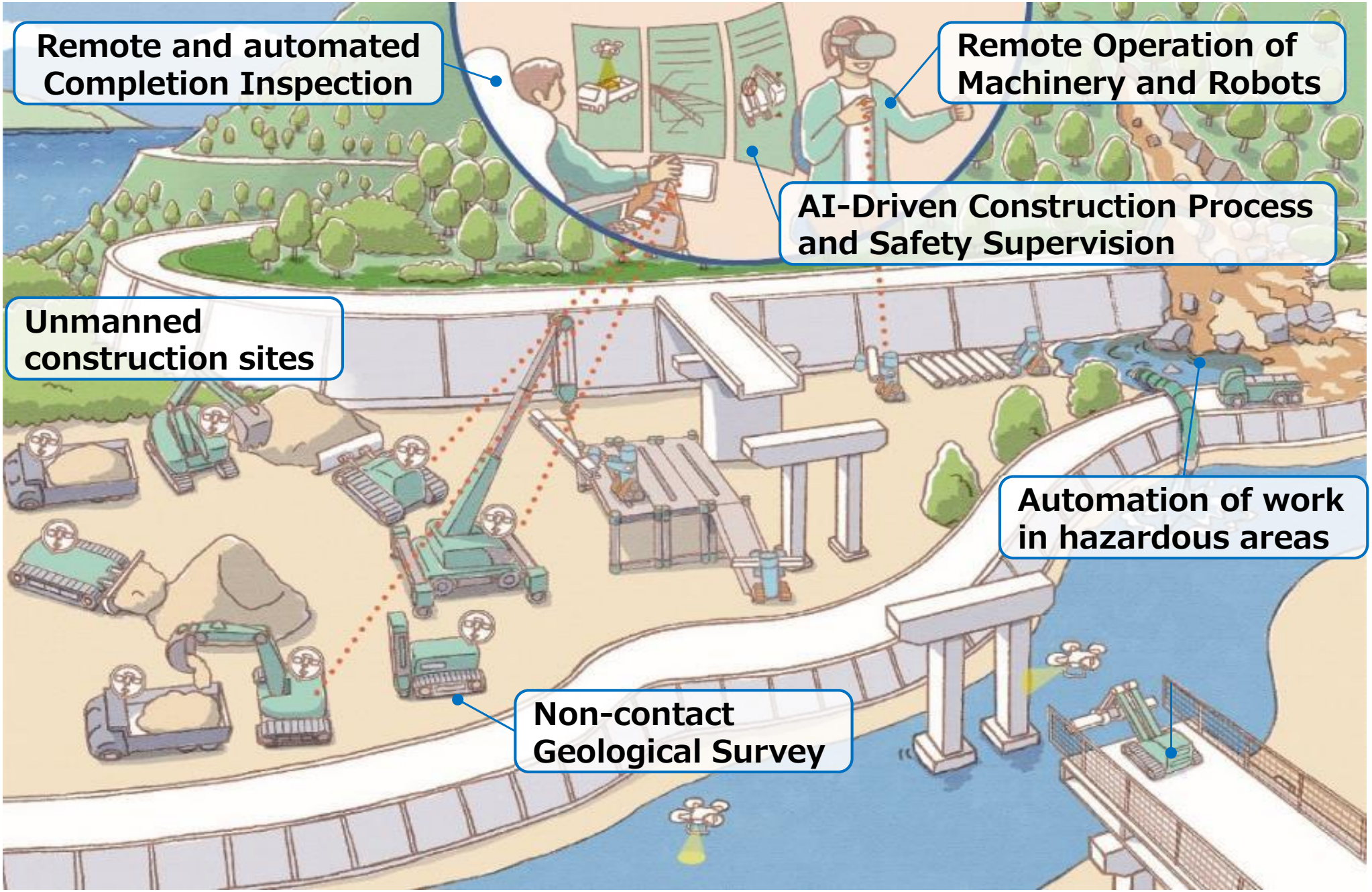
Point Cloud Data

2D drawings

GIS

…etc.

1.1 Our current initiatives in MLIT (i-Construction, BIM)



i-Construction（Image of construction site to be realized by FY2040 ）

1.2 Characteristics of our projects in MLIT

- **Separation of design and construction**
- **Rating construction companies**
- **Setting local requirements**

BIM/CIM

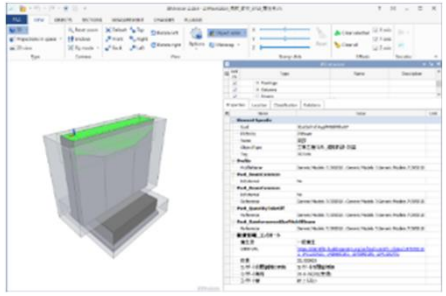
"Building / Construction Information Modeling, Management"

- BIM in MLIT's infrastructure sector is called "BIM/CIM".
- sharing / using digital data to improve the productivity throughout the lifecycle.

Definition of "BIM/CIM"

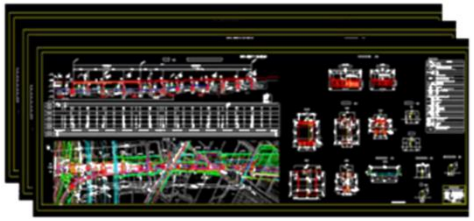
By digitizing the information handled in construction projects, it will be easier for clients and buyers involved at each stage to use and share data, improving the efficiency of the entire construction project. 3D models and reference materials will be used as a means of sharing information.

3D models



Point Cloud Data

2D drawings

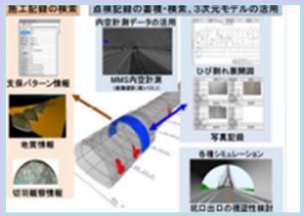


GIS

...etc.

1.4 Previous / Prospectus directions of BIM/CIM

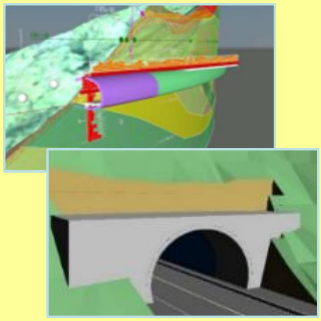
Maintenance



Current goals

Efficient maintenance management using design and construction data

Surveying and Design



Current Initiatives

Prevent design errors by visualizing shapes and overlaying

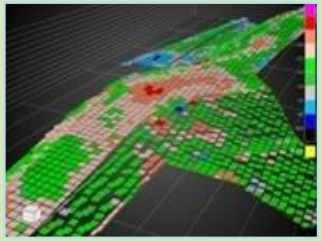
Current goals

Improving the efficiency of design inspections

BIM/CIM

Sharing information

Supervision and inspection



Current Initiatives

Check the finished product using heat maps

Current goals

Paperless

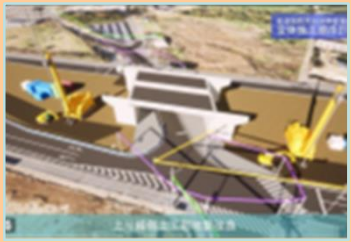
Discussions and explanations with stakeholders

Current Initiatives

Current goals

Facilitating consensus building

Construction



Current Initiatives

Utilizing design data for construction machinery and factory manufacturing

Current goals

Automated and self-disciplined construction

Cost Estimation

Current goals

Automation and facilitation of estimation work

2. Recent activities around BIM/CIM

- BIM/CIM Mandate (April 2023)
- Ongoing Activities (as of FY2024)
- Details on each activities

2.1 BIM/CIM Mandate（April 2023）

1. 3D model utilization

Mandatory uses :

- for every* Detailed Design / Construction stages to implement.
- easy to try for non-experienced contractors. “visualization” centric.

—— * With some exceptions

Recommended uses :

- little more advanced than mandatory uses.
- for relatively big and complicated projects to implement.

2. Client-led data handover ("DS, Data Sharing")

- obligates the client to assuredly provide information created in the previous stages upon each contract.

Scope of application

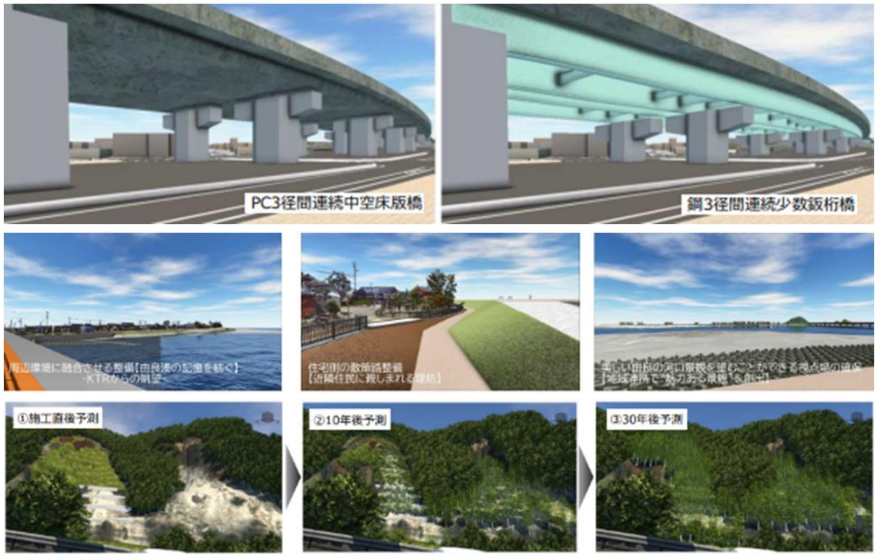
3D model utilization	**Mandatory uses**	Detailed Design, Construction * exception: electrical/telecommunication related projects, disaster recovery works
	Recommended uses	All stages (of a big / complicated projects)
DS (Data Sharing)		All stages

2.1 BIM/CIM Mandate（April 2023）

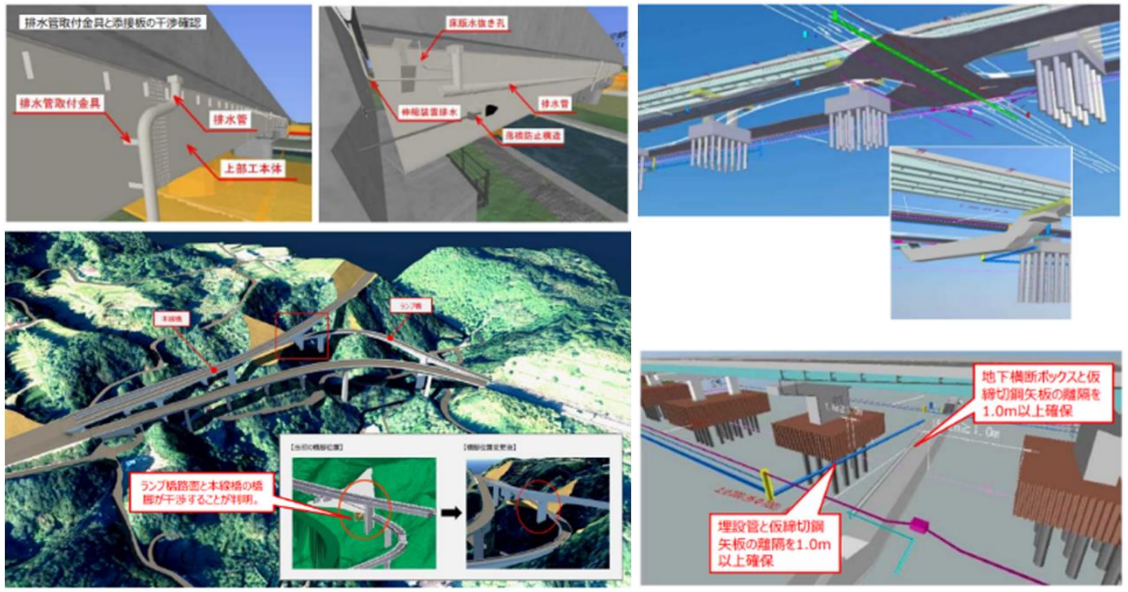
Examples of **Mandatory uses**:

Stage	**Use case**	Purpose
Detailed Design	**Reviewing the finished design of assets**	visualization
Detailed Design	**Reviewing intricate parts**	visualization
Construction	**Preparation of construction plans**	visualization
Construction	**Supplement to comprehend 2D drawings**	visualization
Construction	**Giving/Sharing directions on workers at construction sites**	visualization

Reviewing the finished design of assets



Reviewing intricate parts

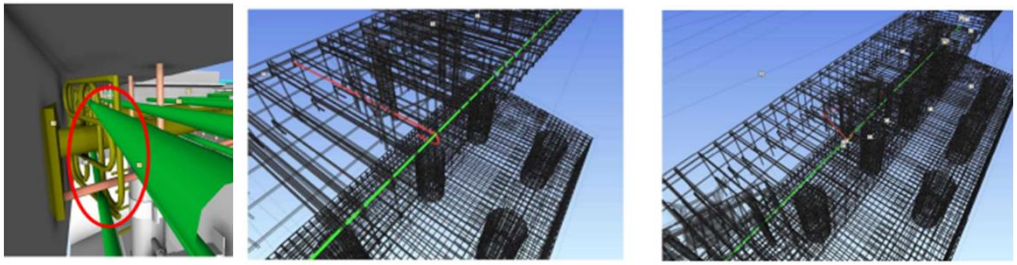


2.1 BIM/CIM Mandate（April 2023）

Examples of **Recommended uses**:

Stage	**Use case**	Purpose
all stages	**Spatial coordination**	visualization
all design stages (conceptual to detailed)	**Business planning**	visualization
Construction	**Construction management**	lean operation
Construction	**Visualizing blind spots**	ease of information gathering

Spatial coordination



Business planning

Construction management

2.2 Ongoing Activities (as of FY2024)

- **DS (Data Sharing)**

  Current goals : Data sharing throughout the lifecycle

  Current Initiative: Reusing design data for construction machinery and factory manufacturing

- **3D Model-Based Design**

  Current goals : Standardization of 3D model-based design, Automation of design verification

  Current Initiative: 3D-based modeling in Detailed design stage
  (Linkage with 2D drawings have not been established)

- **Simplification / Automation of Cost Estimation**

  Current goals : Reusing attribute information of 3D models to automate cost estimation and checks

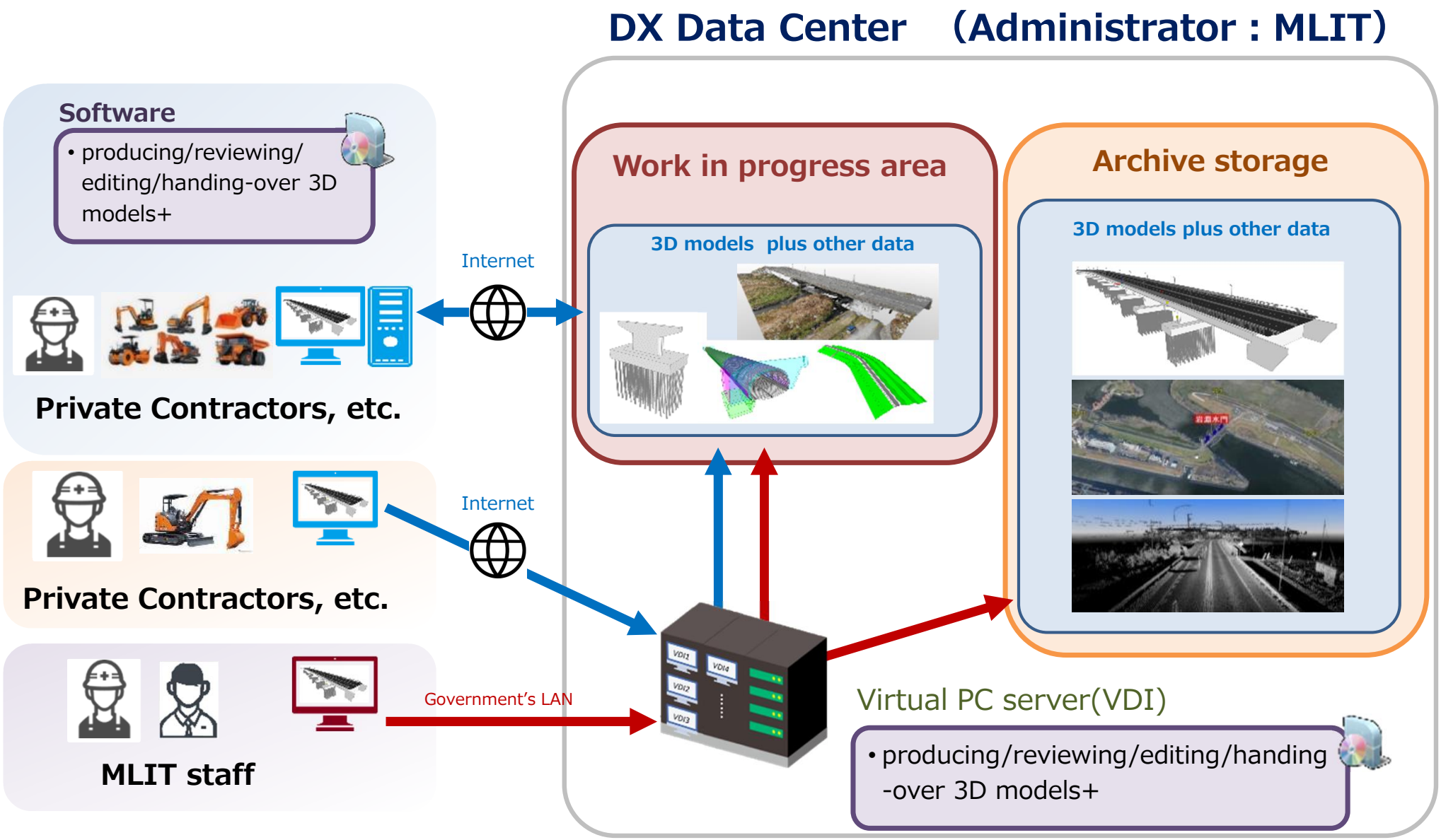
  Current Initiative: Enhancing and extending use cases

- **Paperless**

  Current goals : Working with digital data only in supervision and inspection stages
  (no reports in printed form are allowed)

2.3 Details on each activities

DS (Data Sharing)



2.3 Details on each activities

DS (Data Sharing)

Examples in Dam Construction

MLIT (Client)

Contractor

Designer

Construction track record

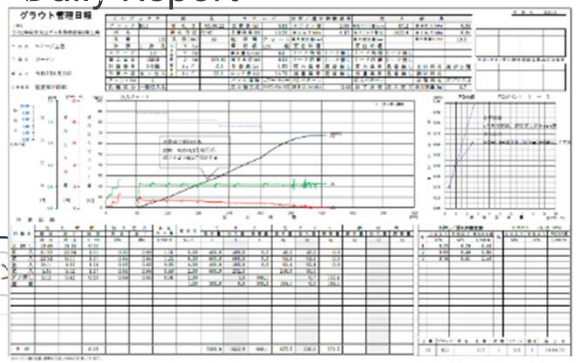
Analysis and Evaluation

Cloud storage

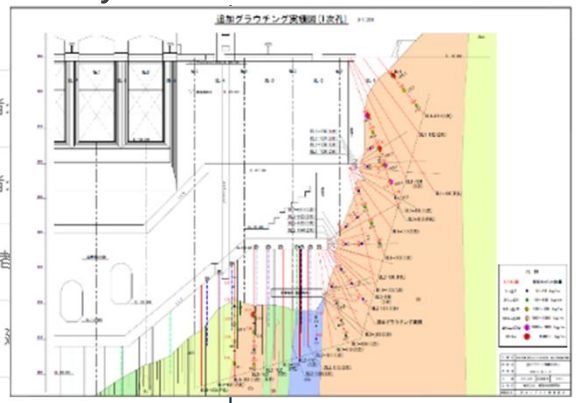
> 1000_ダムサイト統合CIMモデル > 1075_旧堤体追加グラウチング

名前 ↑	更新日
00_施工仕様	2023年5月18日、更新者:
	2024年3月25日、更新者:
	2023年12月12日、更新者
	2024年5月8日、更新者:
	2023年5月18日、更新者
	2024年3月26日、更新者:
50_漏水量・揚圧力・継目計の観測記録データ	2024年1月12日、更新者:

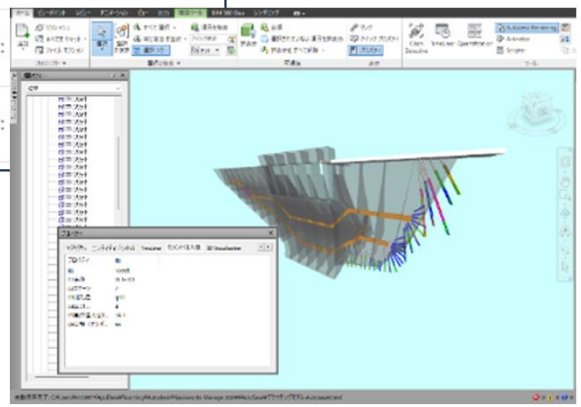
Daily Report



Analysis Data



BIM/CIM



2.3 Details on each activities

3D design

As Is

Situation on the construction site
(2D data)

Design Process (2D)

Shape Assumptions ⇔ Structural calculation

shape determination

2D drawing

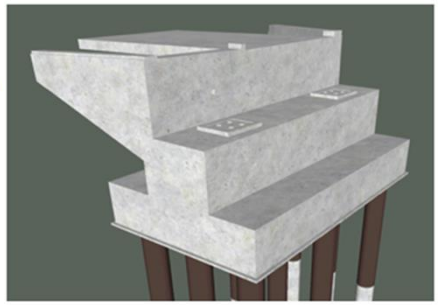
Calculation of quantity

Report

Create a 3D model separately

To be

Situation on the construction site
(3D data)



Design Process (3D)

3D Shape Assumptions ⇔ Structural calculation

2D drawings are created by cutting out 3D

shape determination

2D drawing

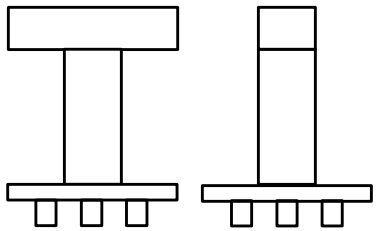
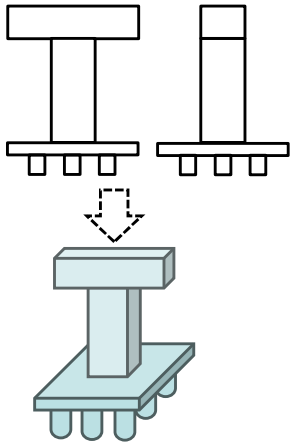
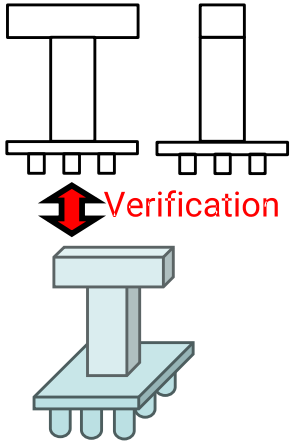
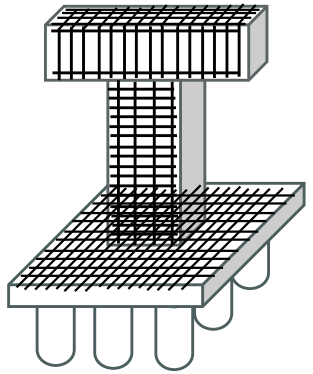
Calculation of quantity

Quantities are automatically calculated from 3D models

Report

2.3 Details on each activities

3D design

	LEVEL-0	LEVEL-1	LEVEL-2	LEVEL-3
Time axis	Past	Present	Within 5 years	future
Deliverables	2D Drawing	2D Drawing 3D Model	2D Drawing Verification 3D Model	3D Model
Detail		 Unverified	 Linking 3D models and 2D drawings of structures (excluding reinforcement)	 3D design including details and accessories
Effect	• Visualization	• Visualization • Improving design quality • Utilization in field manager and inspection	• Automatic design	

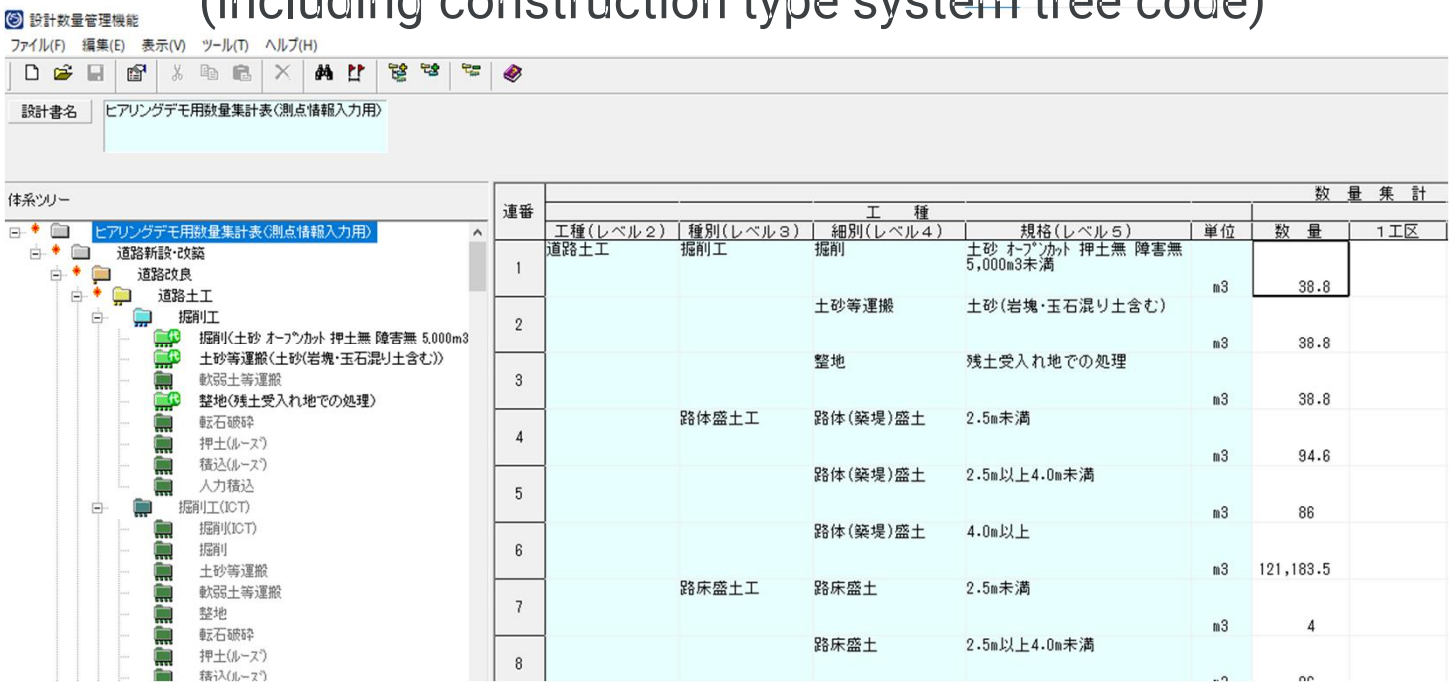
2.3 Details on each activities

Simplify and automate cost checks

Construction work type tree code
(a code linked to the contents of the construction work systemized for cost estimation)

L0コード	L1コード	L2コード	L3コード	L4コード	Lv0体系名称	Lv1体系名称	Lv2体系名称	Lv3体系名称	Lv4体系名称	レベル	単位	単位
1470400101					河川改修					0	式	式
1470400101	1045600101				河川改修	築堤・護岸				1	式	式
1470400101	1045600101	1012700102			河川改修	築堤・護岸	河川土工			2	式	式
1470400101	1045600101	1012700102	1000600102		河川改修	築堤・護岸	河川土工	掘削工		3	式	m3
1470400101	1045600101	1012700102	1000600102	B000705101	河川改修	築堤・護岸	河川土工	掘削工	掘削	4	m3	式
1470400101	1045600101	1012700102	1000600102	B000705201	河川改修	築堤・護岸	河川土工	掘削工	土砂等運搬	4	m3	式
1470400101	1045600101	1012700102	1000600102	B000705201	河川改修	築堤・護岸	河川土工	掘削工	土砂等運搬	4	m3	式
1470400101	1045600101	1012700102	1000600102	B000705201	河川改修	築堤・護岸	河川土工	掘削工	土砂等運搬	4	m3	式

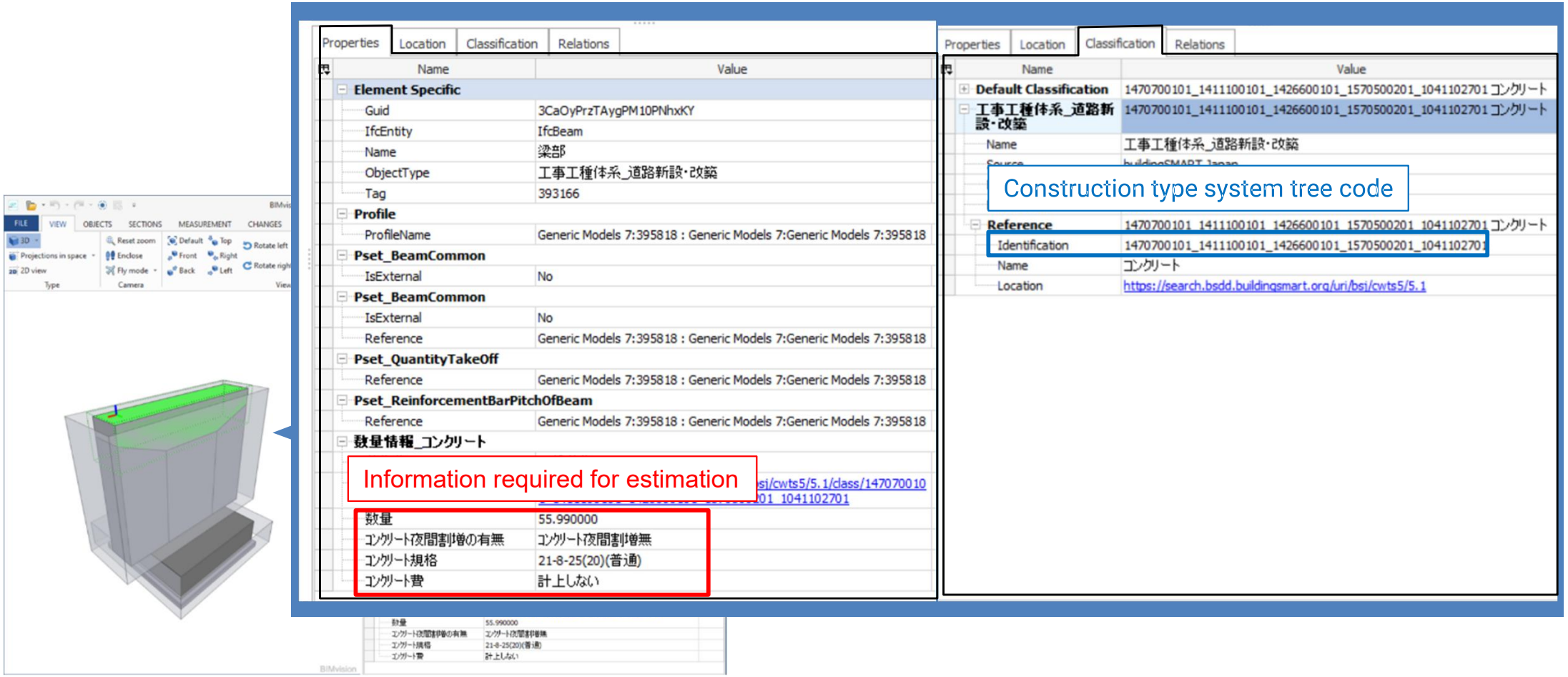
Design quantity management function
(including construction type system tree code)



2.3 Details on each activities

Simplify and automate cost checks

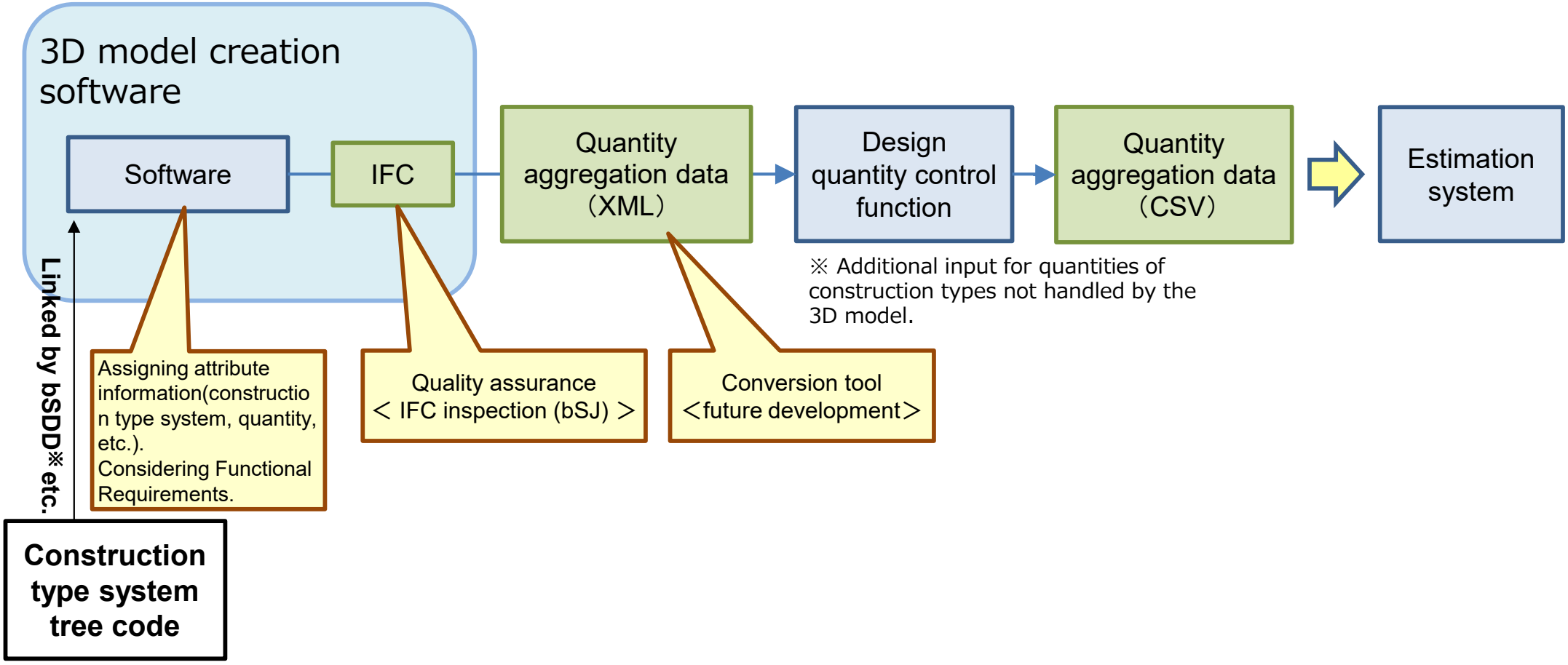
Example of assigning attribute information to RC piers.



2.3 Details on each activities

Simplify and automate cost checks

BIM/CIM estimation flow



※ bSDD (buildingSMART Data Dictionary) :
Library of terms referenced in IFC models. (provided by bSI) https://technical.buildingsmart.org/services/bsdd/

Thank you for your attention.