

# THE STRATEGIC APPROACHES TO ENHANCE THE BIM AND CIM APPLICATION IN JAPAN

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## i-Construction in Japan

## Current Situation of Infrastructure in Japan

Percentage of infrastructures after 50 years of construction

	2013	2023	2033
Bridges/400,000	18%	43%	67%
Tunnels/10,000	20%	34%	50%
River Management Facilities (e.g. floodgates) /10,000	25%	43%	64%

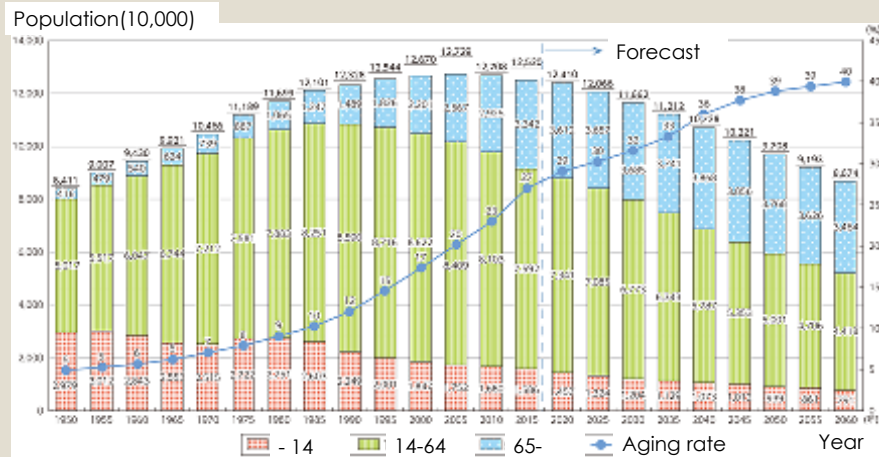
Source: Cabinet Office

## Maintenance and Renewal Costs of Infrastructure

2013	2023	2033
3.6 trillion yen (=31 billion euro)	4.3 -5.1 trillion yen (=37- 43 billion euro)	4.6 – 5.5 trillion yen (=39-47 billion euro)

Source: Cabinet Office

## Population Forecast by age group



Source: Ministry of Internal Affairs and Communications

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## What is “i-Construction”?

- The Japanese Government aims to increase productivity in the construction industry by 20% by 2025. (e.g. shortening construction period and reducing workforce by using ICT.)
- **i-Construction** is one of the strategies of the Ministry of Land, Infrastructure, Transport and Tourism, MLIT, which aims for the maximum use of Information and Communication Technology, ICT, to increase productivity in the construction industry.

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## BIM/CIM are the main engine of i-Construction

- BIM: Building Information Modeling/Management
- CIM: Construction Information Modeling/Management  
=BIM for infrastructure (Road/River/Dam/Bridge/Tunnel)
- By introducing the BIM/CIM model from the process of planning/surveying to the process of designing/construction and maintenance, all parties involved in the project can communicate and collaborate internally and externally.

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## CIM model

- CIM model expresses both the shape of a structure in 3D and attribute information for infrastructure.

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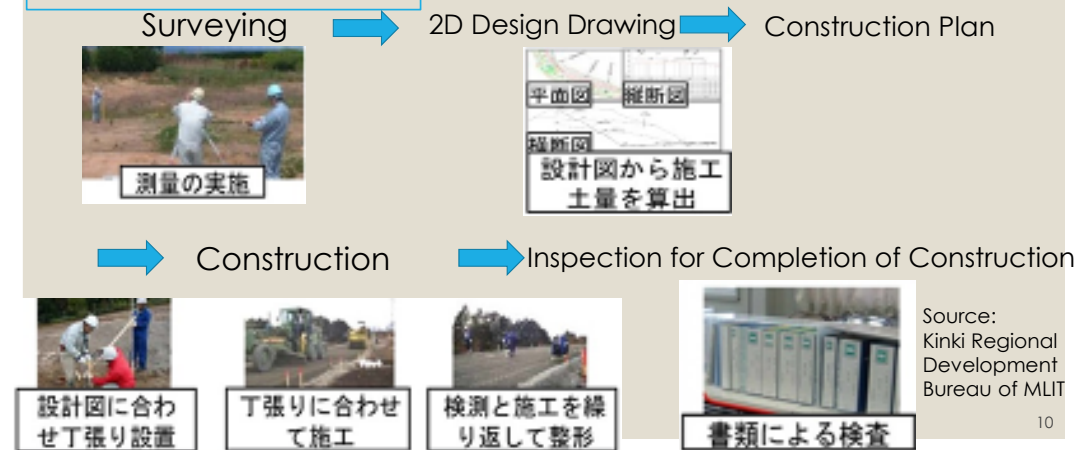
## Features of infrastructure

- The necessary information for infrastructure, such as earthwork, river, dam, bridge, tunnel, depends on the type of infrastructure.
- The model has curves and unique dimensions, because of the landform.
- Contractors need to consider the deformation of the infrastructure in the construction period, monitor several displacements and update the attribute information.

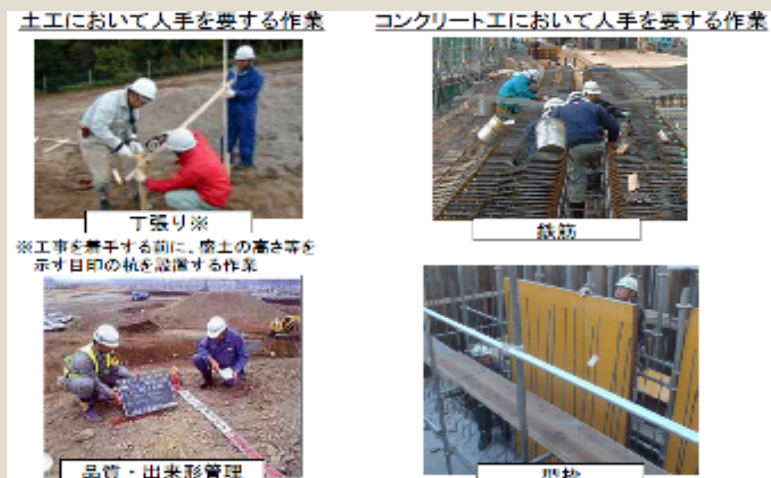
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## Earthwork for Road

### Conventional method



- Conventional method is more labor intensive.



- The 2D drawings show the topography with contour lines.
- However, errors between the actual ground height and the height in the 2D drawing are usually not small.
- Contractors have to survey the ground height, and decide the connecting structure on the construction site.

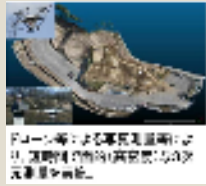
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## i-Construction

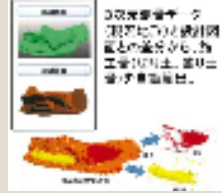
3D Design



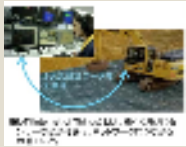
3D Surveying



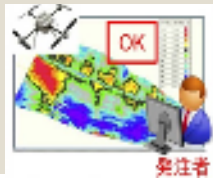
Design Drawing  
Construction Plan



Computerized  
Construction



3D inspection for Completion  
of Construction

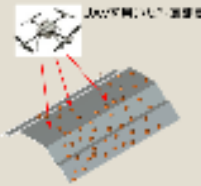
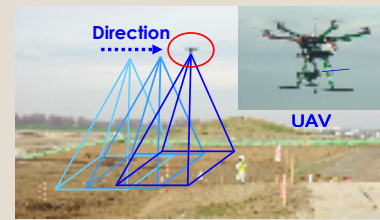


Source:  
Kinki Regional  
Development  
Bureau of MLIT

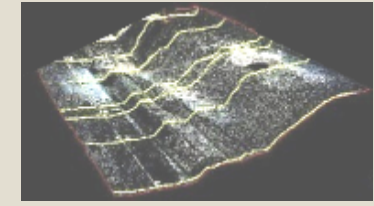
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## ICT survey

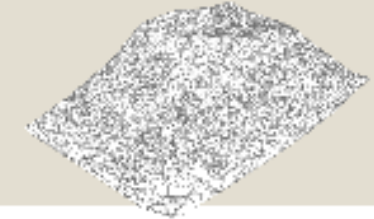
① UAV photogrammetry



② point cloud data



③ surface model

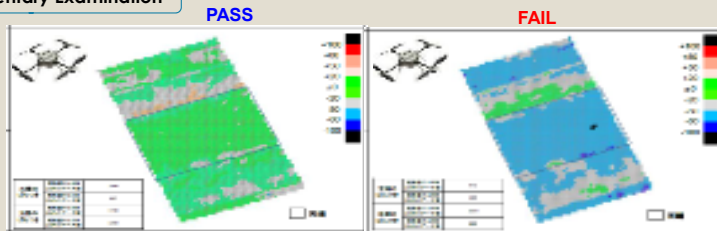


Source:  
Kinki Regional  
Development  
Bureau of MLIT

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## ICT Inspections

Documentary Examination



The errors between 3D data as built and 3D plan data

On-Site Examination



(TS)



(GNSS Rover)

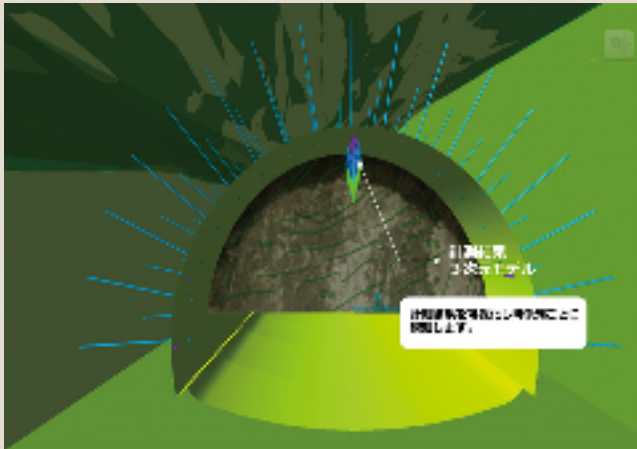
Source:  
Kinki Regional  
Development  
Bureau of MLIT

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- Accuracy of conventional inspections depends on the performance of inspectors.
- On the other hand, UAV and 3D laser scanners can automatically inspect accuracy.

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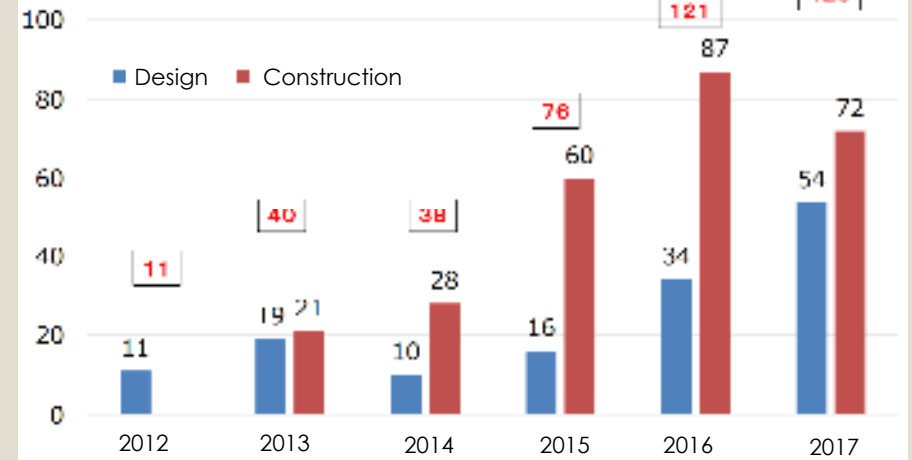
## Monitoring dimensions of tunnels



Source: Autodesk

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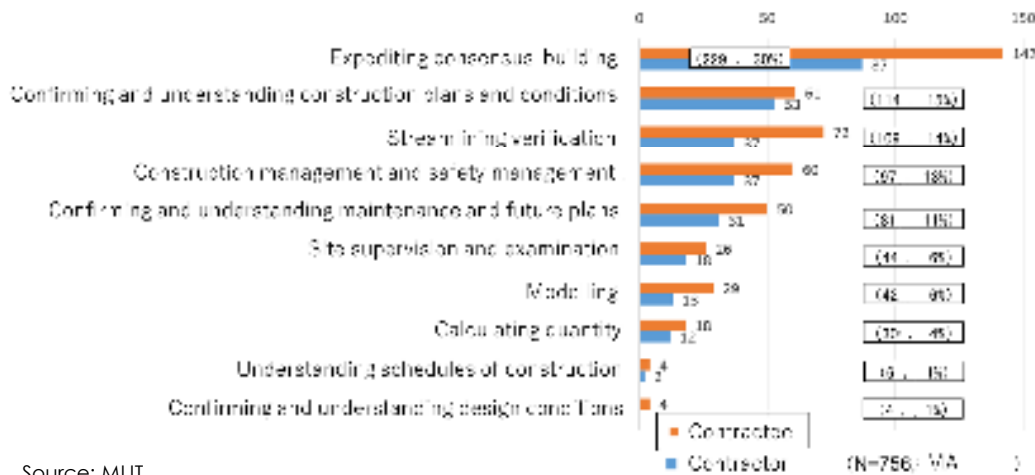
## No. of pilot projects of CIM



Source: MLIT

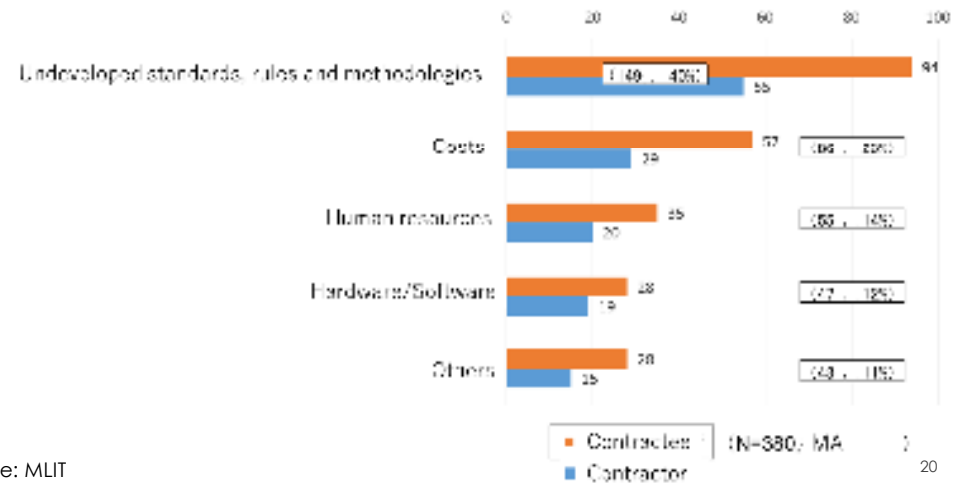
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## Effects found by pilot projects



Source: MLIT

## Issues found by pilot projects



Source: MLIT

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## Issues found by BIM/CIM pilot projects

### Design companies

- After making a 2D drawing, a 3D model tended to be developed.
- Most companies have several specialized divisions for designing; software in the specialized divisions was different.
- Some companies outsourced the development of models for the pilot projects.
- Such companies didn't have incentives to develop 3D models at this stage.

Source: MLIT+some companies 21

### General Contractors

- The person in charge of BIM/CIM in the head office supports the pilot projects which were undertaken in the regional branches and offices

### Small and Middle-Sized Construction Companies

- Shortage of knowledge about BIM/CIM
- Shortage of human resources for introducing BIM/CIM
- Hesitation to invest on the BIM/CIM at this stage

Source: MLIT+some companies 22

### Public Authorities

- Shortage of human resources for educating both contractees and contractors about BIM/CIM
- Contractees learned the effectiveness of BIM/CIM through the experience of pilot projects.

Source: MLIT 23

## To enhance the BIM/CIM applications

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## Strong Public Leadership

- The Japanese government promotes this movement.
- MLIT established Committees for introducing BIM/CIM in infrastructure/starting from 2012

### Tasks of Committees

- To develop the guidelines/technical standards etc
- To describe a compelling vision, goals for introducing BIM/CIM
- To increase the competences of public authorities
- Pilot projects have been conducted by MLIT.

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## Building a Collaborative Framework

People in the projects need to build a collaborative framework for increasing productivity by using CIM models.

e.g. At initial stage

(role sharing; It is not necessary for all members to be experts in the use of CIM model and software)

CIM divisions: mainly make a 3D model

On site workers: mainly update and change attribute information

All members have accesses to the CIM model for collaboration

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## Running Skill-up Programs

- Skill up programs provide good opportunities for construction industries to develop the knowledge as well as to clarify issues and to discuss the methods of BIM/CIM improvement based on the experience of projects.

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## References

Autodesk

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**Thank you very much.**