Japan-DK-seminar, Copenhagen

September 13, 2019

Theme 2: Construction Kaizen as a bottom-up-pull

A Notable Technology in Construction

1. Visual Construction

2. Work-style reformation

Ritsumeikan University

Kazuyoshi Tateyama

RITSUMEIKAN

A Notable Technology in Japanese Construction

1. Visual Construction

Advanced Management utilizing Video Information

Construction period : 17th July 2014 – 27th March, 2015 (about 8 months)

Client : Ministry of Land、Infrastructure and Transport

Contractor : Kani Construction Co. Ltd.

Description of work : Remedial work of river embankment (3,100m^3)

Development of a system to record and share the information of construction site

Intelligent database system

Video Recording System

System Configuration

SU1

Camera1

Observation; Excavation

Camera2

Visualization of whole site

Camera3

Observation: embankment

Camera4

Observation : River water level

CMS

Observation viewer

PoE Switching HAB

Power supply, Network device

Network Video recorder

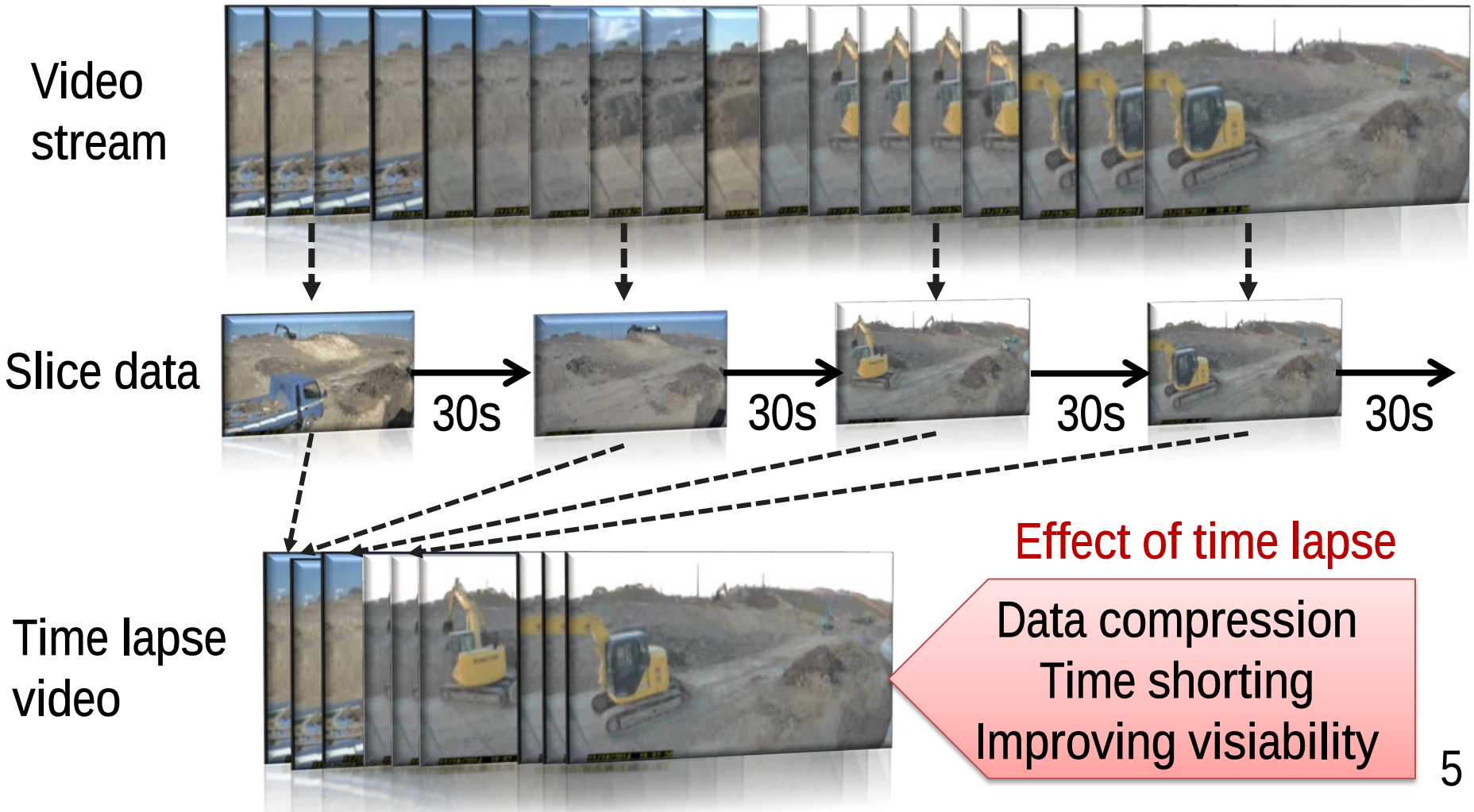
Mobile terminal

Remote access

Internet

Time lapse video system

A method of creating a video from still images recorded at regular intervals. It can express changes in events over a long period of time with a short time video.



Example of time lapse video by Kani Construction Co. Ltd.

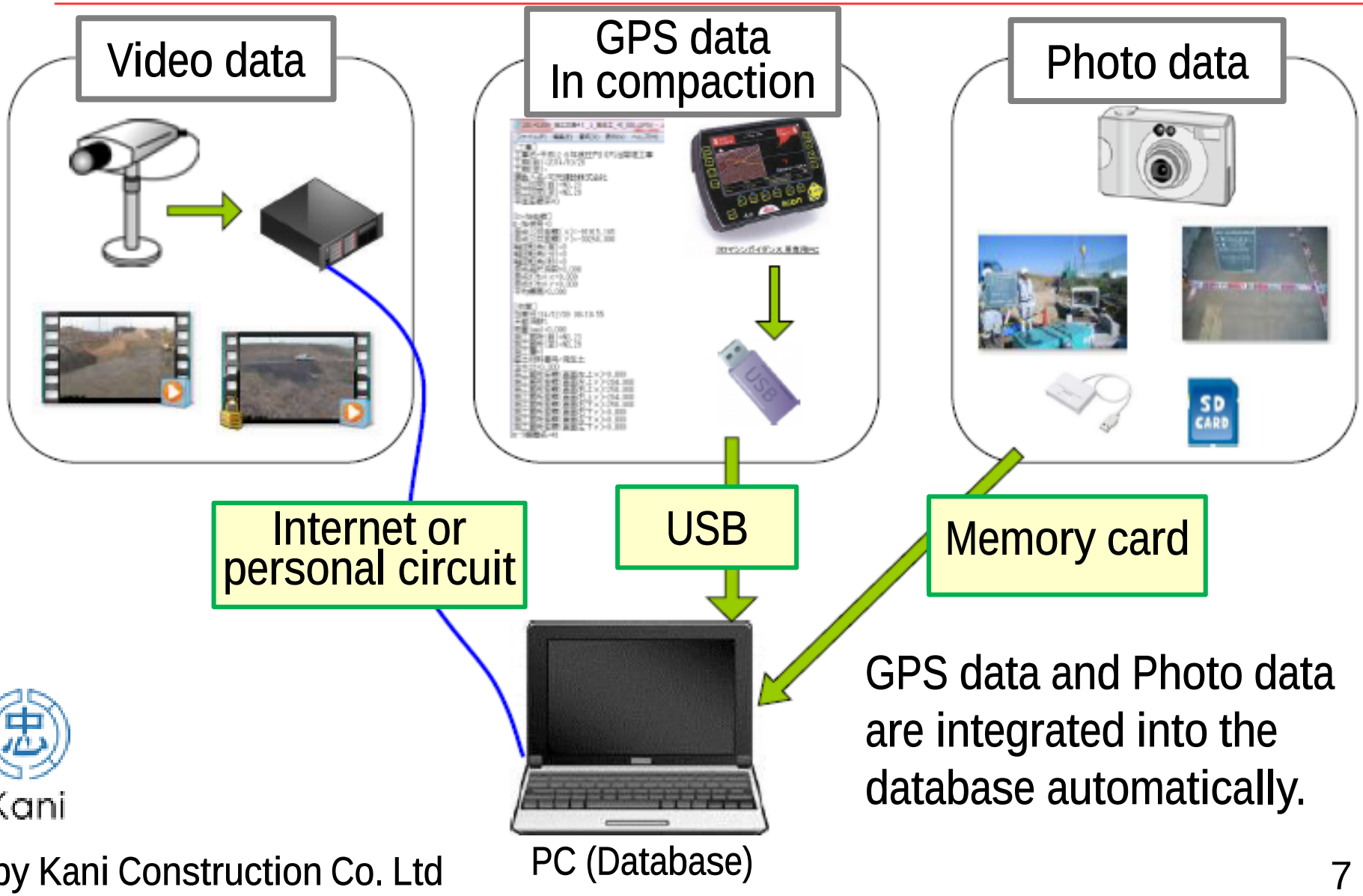
1s slice data (30 x speed)

5s slice data (150 x speed)

10s slice data (300 x speed)

30s slice data (900 x speed)

Recording of the site information to the database



GPS data and Photo data are integrated into the database automatically.

Kani

by Kani Construction Co. Ltd

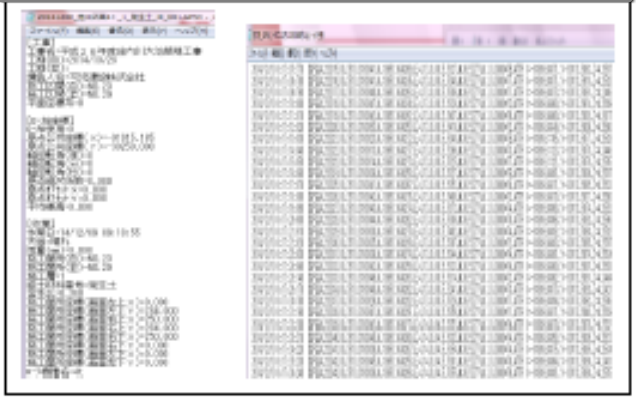
Intelligent database (Listing of data, Visualization)

Original Data

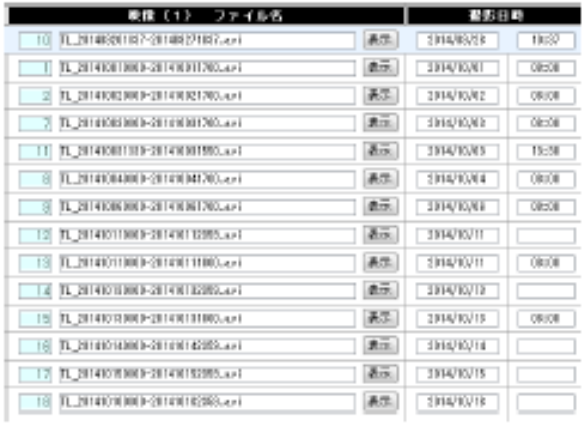
Time lapse data AVI

Photo data JPG

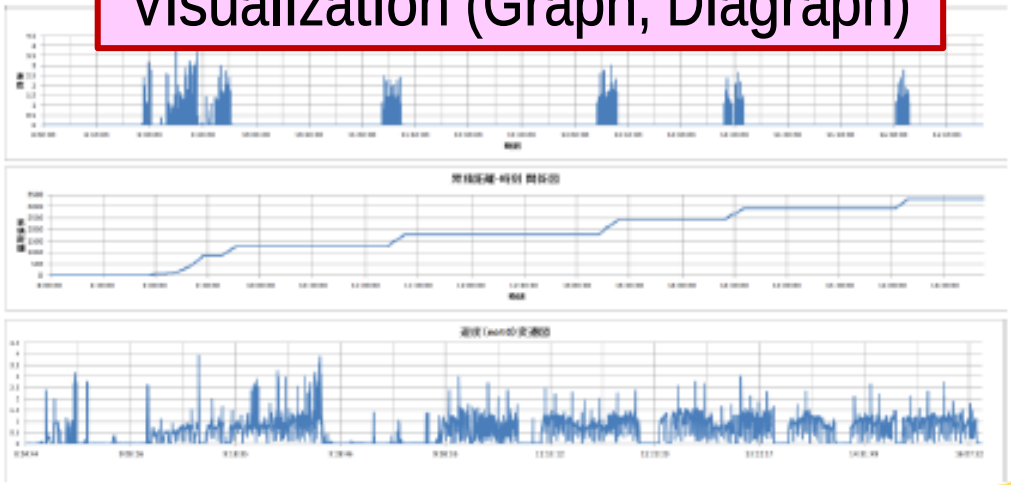
GPS data TXT



Automatic listing function for DB

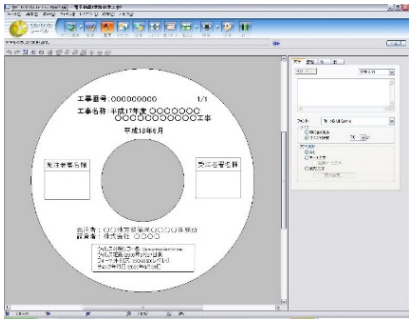


Visualization (Graph, Diagraph)



Advantage of Utilizing Video Data in Construction

(1)Recording function of video data



- Cause analysis in case of malfunction or accident
- Verification of construction plan and its feedback
- Simplification in management tasks
  (Reduction of huge amount of documents)
- Advance examination of preceded construction by archiving

(2) Visual education of employees

- Small companies highly dependent on the skills of individual engineers.

→ **Improving the experience of young engineers** through virtual education.

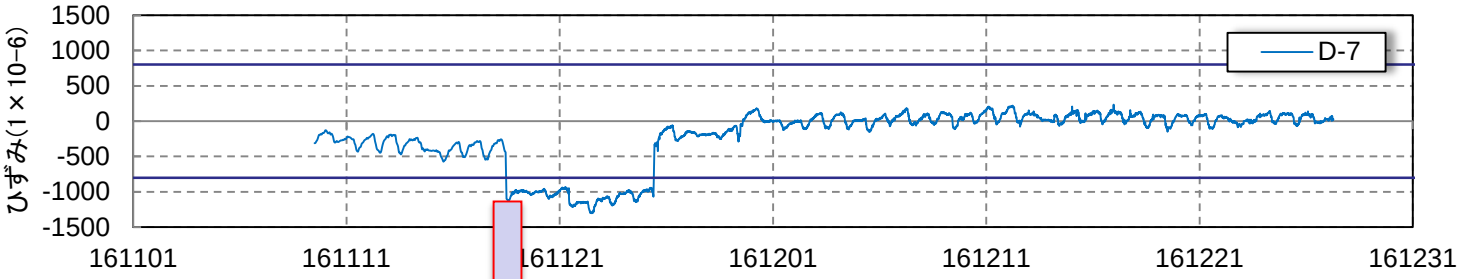
(3) Others

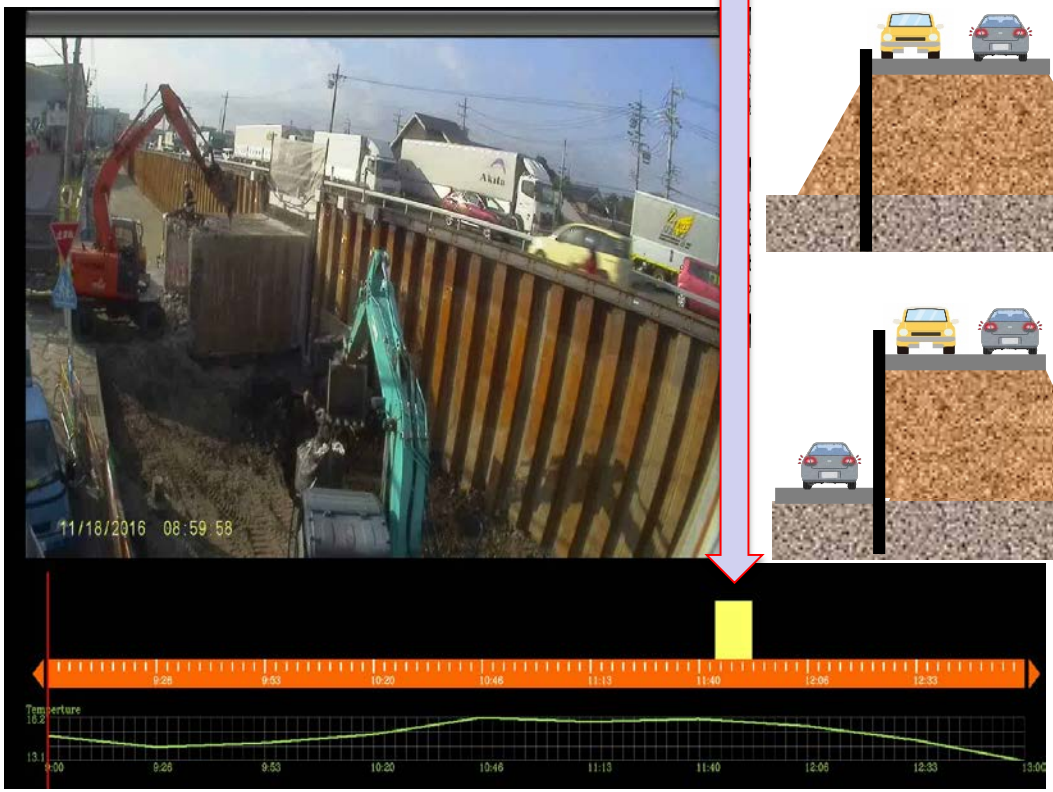
- Sharing of site information between the client and contractor
  (Reducing of inspection works in the sites)
- Suppression of unsafe behaviors

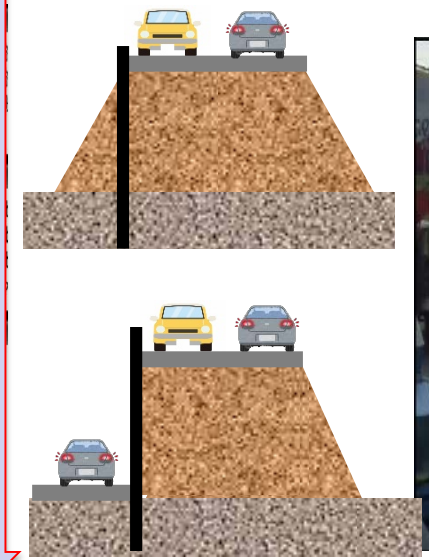
→ **Prevention of occupational accidents**

Recording function of video data

Analysis on the causes of serious events (changes in strain of the sheet piles) from the time lapse video data in widening work of a road







When a concrete wall collapsed, a large vehicle passed over the area.

by Kani Construction Co. Ltd

Use for highway bridge repair work and lane control

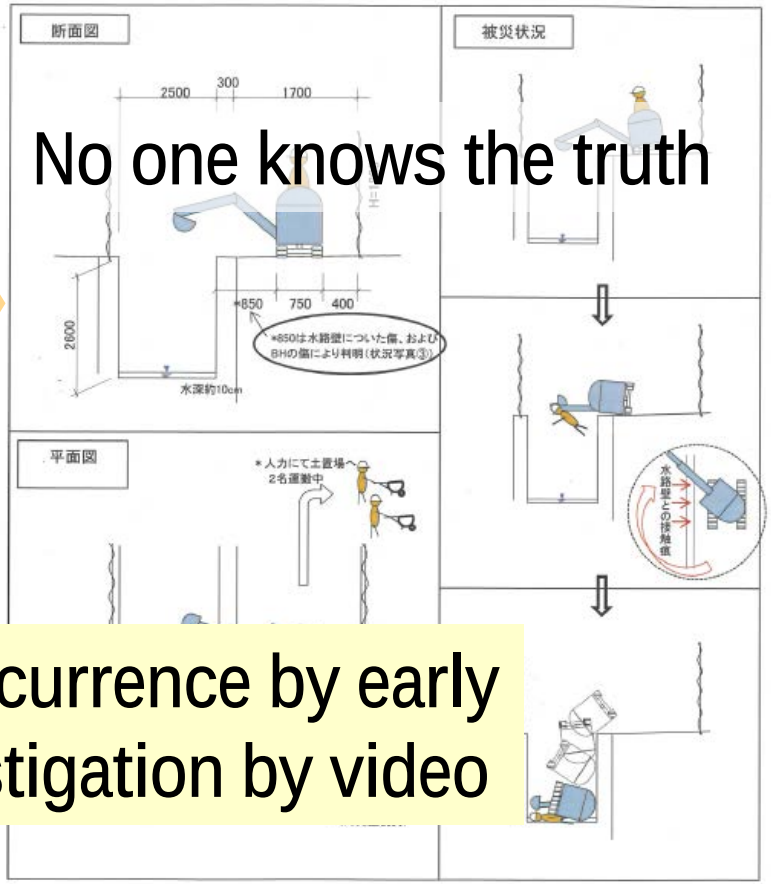
The video data were shared with the contractor and the client whose office was far away from the site.

By Aiki Co. Ltd., Ehime Pref.

Example of machinery accident: The cause of the accident is unknown.

An operator did a leveling work with a mini-power shovel alone.
He was found dead under the shovel in the bottom of a ditch.

The cause was guessed because of no witnesses.



Prevention of repeated occurrence by early detection and cause investigation by video

Improvement of management works using ICT

Reduction of Inspection documents, etc.

#	写真ファイル名	撮影日時	区分
665	20140813-085006.jpg	2014/08/13 08:50:06	0:
666	20140813-085018.jpg	2014/08/13 08:50:18	0:
667	20140813-085038.jpg	2014/08/13 08:50:38	0:
668	20140813-085114.jpg	2014/08/13 08:51:14	0:
669	20140813-085158.jpg	2014/08/13 08:51:58	0:
670	20140814-111605.jpg	2014/08/14 11:16:05	0:
671	20140817-090735.jpg	2014/08/17 09:07:35	0:
672	20140817-090739.jpg	2014/08/17 09:07:39	0:
673	20140817-092022.jpg	2014/08/17 09:20:22	0:
674	20140817-092149.jpg	2014/08/17 09:21:49	0:
675	20140817-092204.jpg	2014/08/17 09:22:04	0:

Database of video data

Quantification of video information

Replacement of inspection documents by video

JICE 一般財団法人 国土技術研究センター
Japan Institute of Country-ology and Engineering

Study group on utilization of video data in construction (2016)

Guideline for video data utilization in construction (2017)

- Streamlining construction records (utilizing the larger usefulness of video than that of photographs)
- Reduction of site inspection through sharing the site conditions with video system
- Facilitating communication between clients and contractors
- Improvement of the safety management

Trial construction → **Standardization**

Expectation to visual construction

- On-site video data contains a wide range of information, from simple information that anyone can easily handle to information that requires advanced technical skills to handle. Depending on the technical level of the user, it can be selected and used effectively.
- There are many applications that have not been developed yet. Development of such new technologies will be extremely useful for the advancement of construction.
- Accumulation of on-site trials and sharing of results will lead to advancement of visual construction technology.

A Notable Technology in Japanese Construction

2. Work-style reformation,

by building new organization
and introducing new facilities

Increasing momentum of technological development triggered by i-Construction

New standards & guidelines such as Public surveying manual

http://www.mlit.go.jp/sogoseisaku/constplan/sosei_constplan_tk_000031.html

The standards and manuals that were apt to be fixed has been greatly revised.

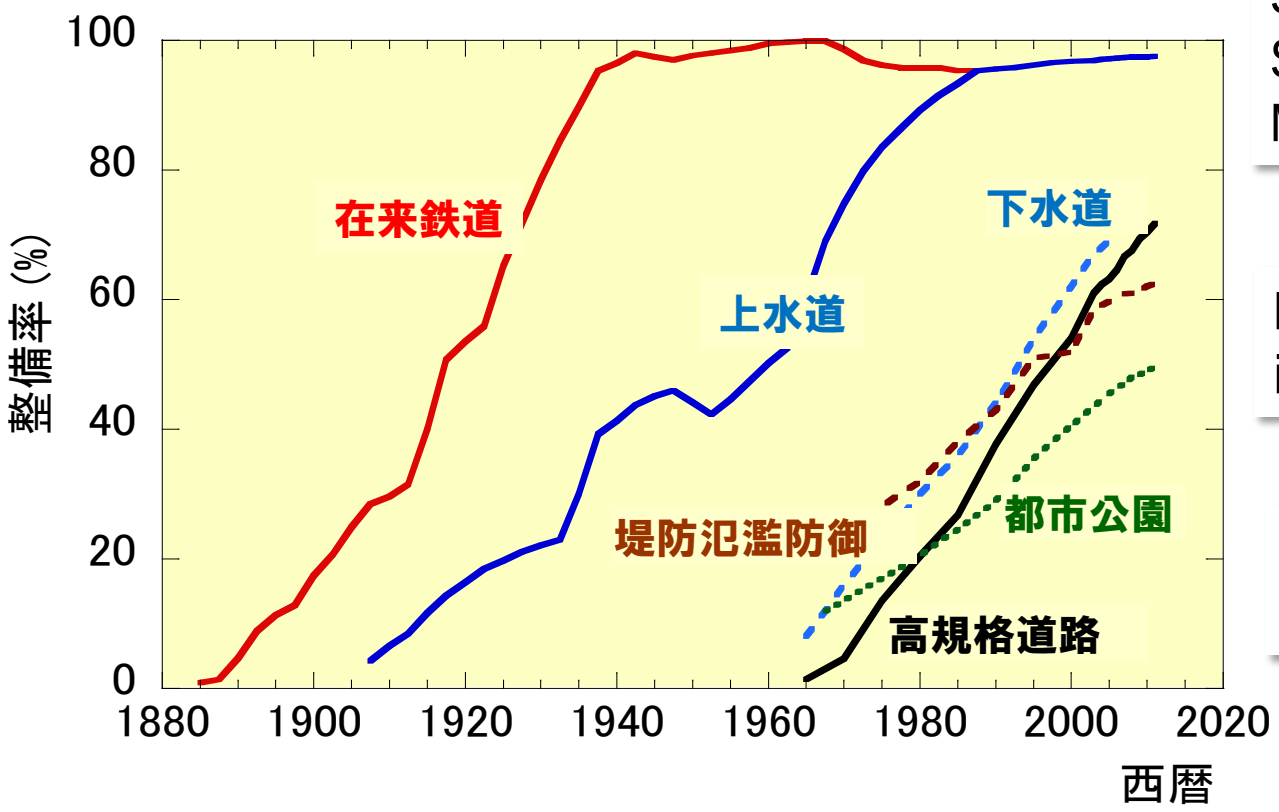
➡ The introduction of many new technologies will be tried according to the actual situation in the field.

Point

It is easier to get a certain effect if you do not aim to introduce ICT but decide on the purpose and consider using ICT.

Expected to increase the momentum for technical development on site.

Improving the efficiency of management work with ICT



Transition of social capital development

Systematization of design
Setting standards
Manual construction

Mechanism for efficient infrastructure development

Increase in administrative work (office work)

Reduction of creativity
Declining intention of new technology introduction

Efficient management work using ICT and reduction of document work

Return of engineers to the field

Promotion of new technology introduction

Work-style reformation by building new organization 1

Uncommonly in the Japanese construction companies, half of employees are women.

H23.8～ CAD講座開設

Koishi, Oita Pref.

Creation of an environment where mothers, building up their children can work easily.

- Flexible working time
- Work with children
- CAD education
- Skill up for each employee

Surveying on sites jobs + Data reduction Indoor jobs

Engineers

Surveying on sites jobs

Engineers

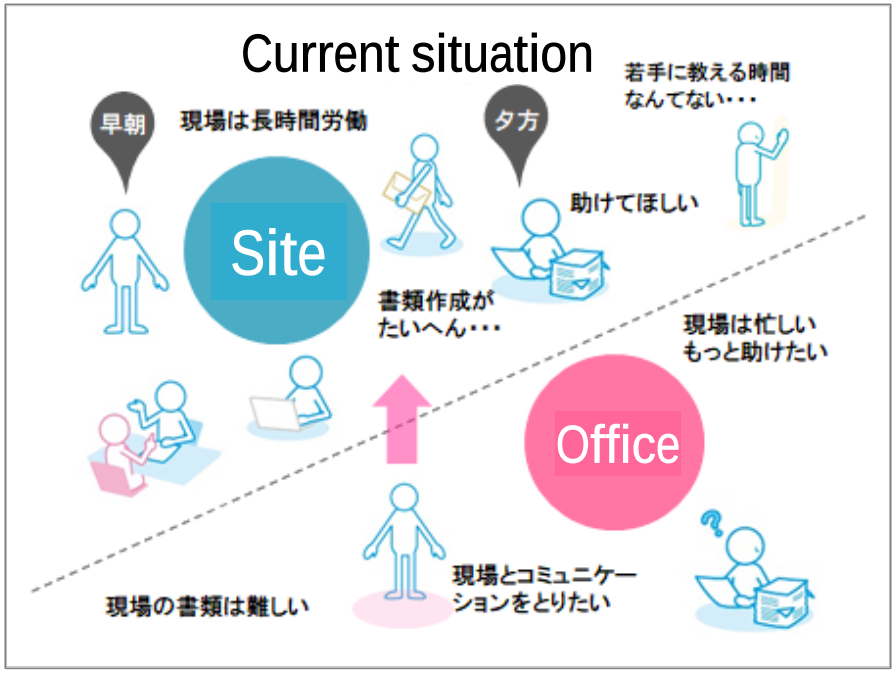
Taking charge more sites

Data reduction Indoor jobs

CAD operators

Job division system with ICT

Work-style reformation by building new organization 2



- Long hours jobs of on-site engineers for document preparation work
- Difficult technology transfer due to lack of human resources
- No communication between site and **office**

- Skill up of office employee by mastering specialized skill of the site managements
- Field support with IT and communication

Women play an active role by changing their work style (role)

- Expansion of office work (addition of duties, relocation)
- Return position for female engineers (maternity leave, childcare leave)
- New employment (ICT, inexperienced person)

Construction Director Training Program

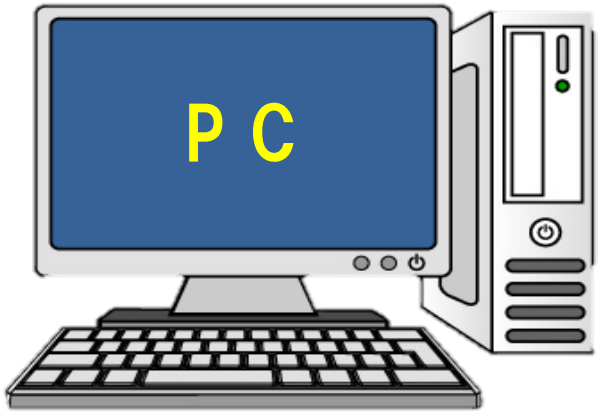
Basic social skills / career / construction law/ construction management / photo & documentation management / CAD / estimation / cost management, communication, etc.

by Kyoto Sander, Kyoto Pref. SANDER

Work-style reformation by introducing new facilities

Data is instantly shared with others via the cloud using communication functions

Cloud
Database on Internet



Utilization of smartphone equipped with application for construction management

Advantages of smartphone

Communication function, camera function, PC function
(Waterproof, dustproof, impact resistance)

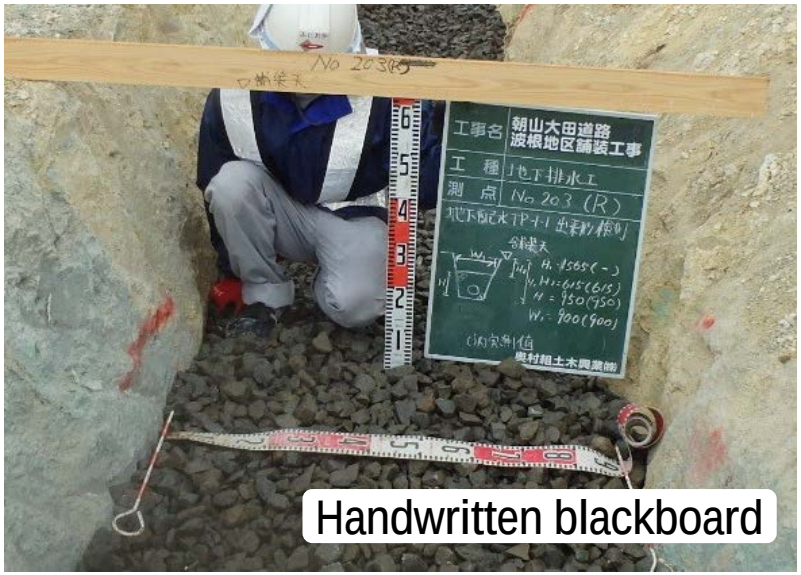
Information sharing with field offices, headquarters / branches

奥村組土木興業株式会社 OKUMURA

株式会社建設システム

Smartphone usage (1)

Streamline on-site photo management

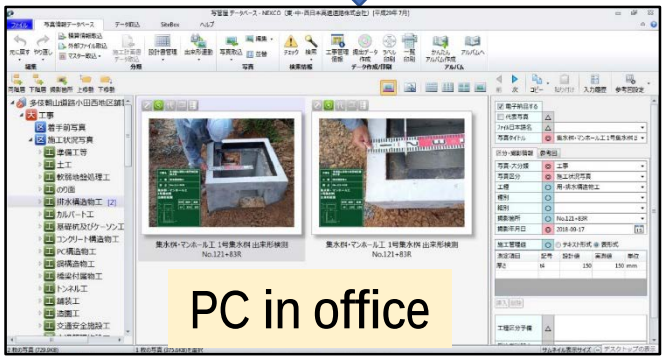


Conventional method

- Carrying a blackboard.
- Rewriting the blackboard for each subject.
- Unclear characters and numerical values
- Cumbersome work for organizing photos

Photo shooting with smartphone + field information input with app

Cloud



- No need to carry a blackboard.
- Blackboard can be created in advance.
- Automatic photo organization

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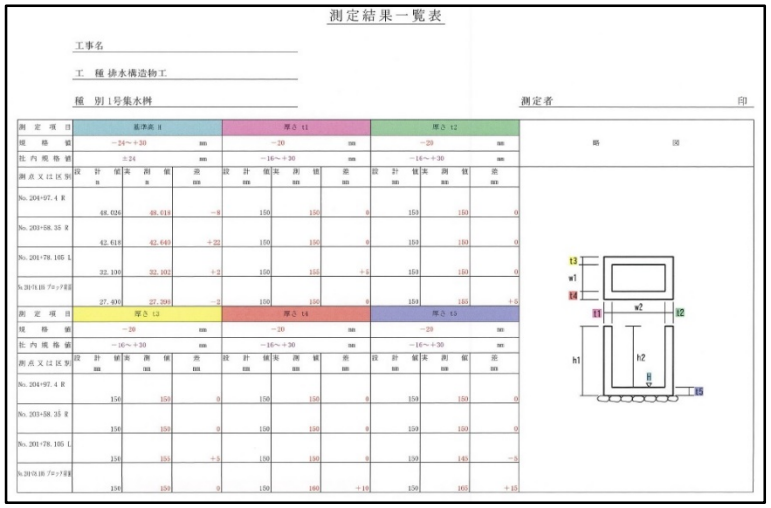
Smartphone utilization (2) Streamlined product management

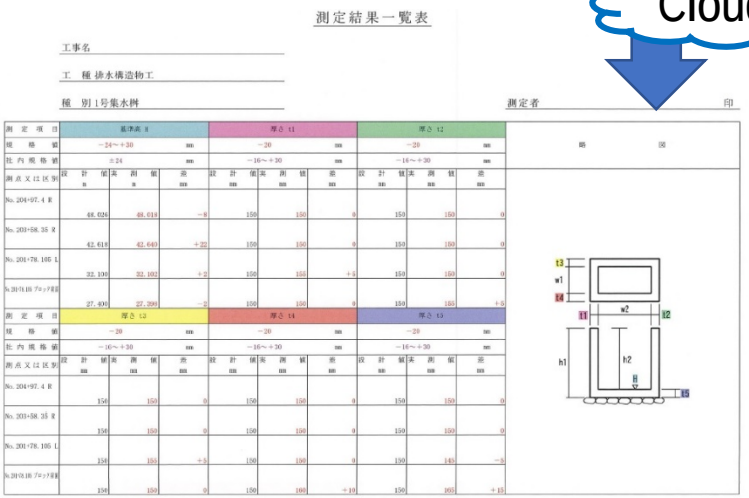
Writing down the measured values and create a document



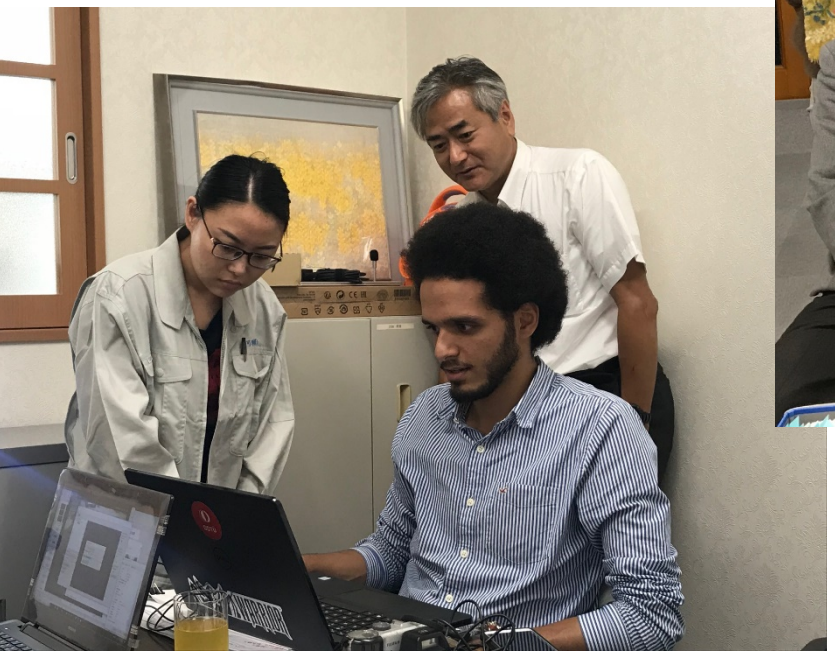
Documents are automatically created simply by reading data

Transfer

Cloud



Employment of foreign engineers



Foreign engineers are employed to do mainly the ICT job which Japanese engineers are not good at, Such as 3D CAD simulation or PC works, etc.

Mr. Abudu (from Egypt, Kani Construction Co. Ltd.)

i-Construction in Roof Construction



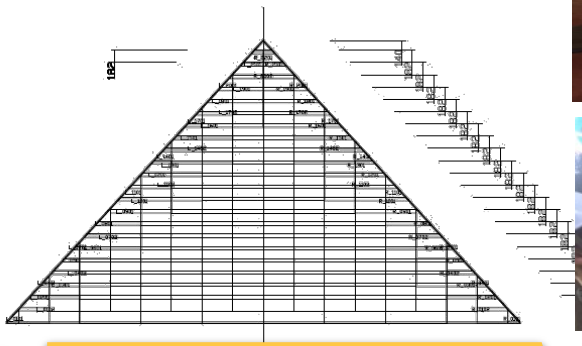
Dangerous Job on high roofs, Aged workmen, Lack of successors
Low productivity.　There are a lot of the issues to be solved.

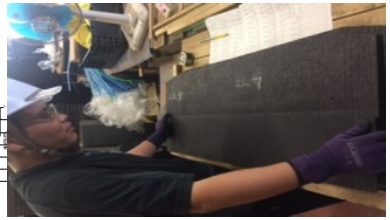
Challenge of Matsuzawa Pantile Co. Ltd.

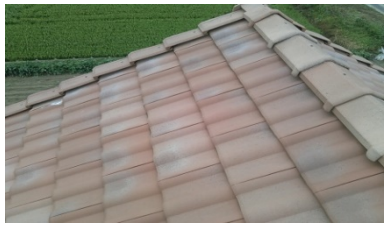
Reduction of works on high roof by changing players from skilled workmen.

MATSUZAWA

i-Construction in Roof Construction







UAV surveying of the shape and size of the roofs as 3D data

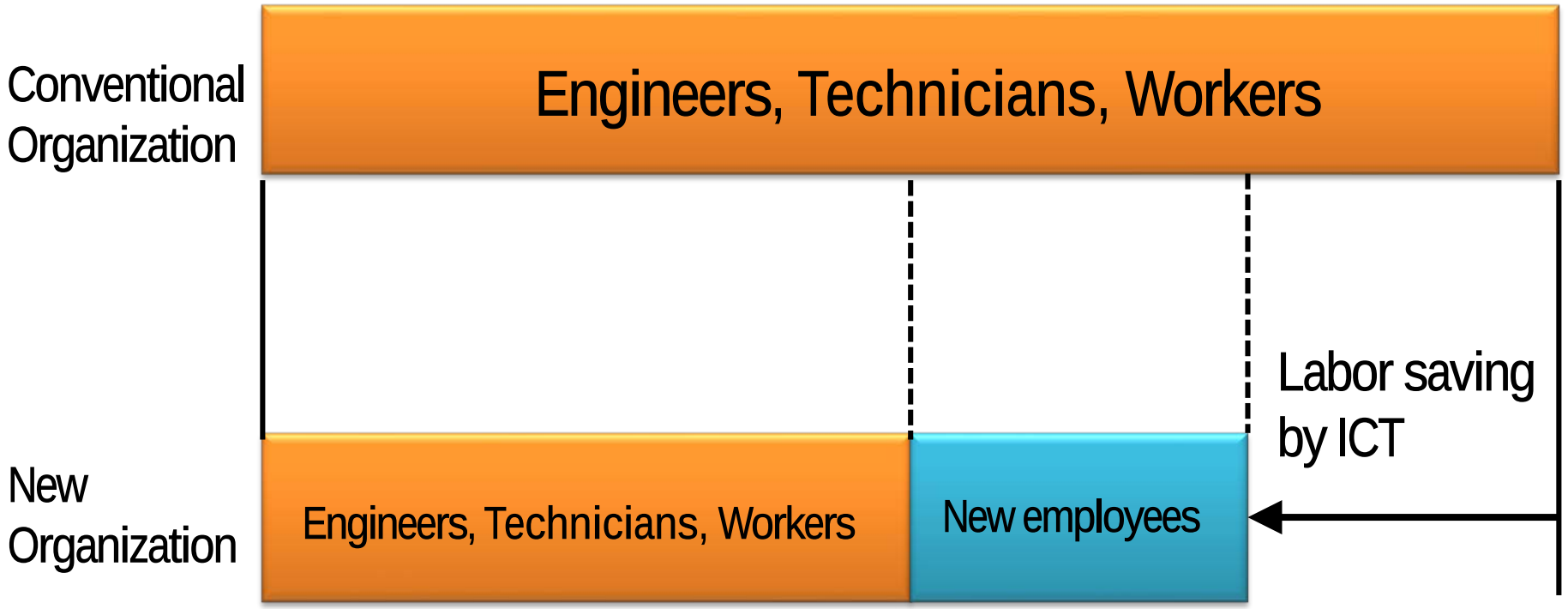
Design, Constructing planning, Estimation with 3D CAD

Precutting of roof tile indoors

Placing roof tiles

Various personnel can enter the construction industry with ICT.
Various trials for Diversification of Professional Staffs has started.

Image of work-style reformation by building new organization



At the end of my presentation

Three years have passed since i-Construction started.

Other than the standard methods, some unique efforts have been begun to improve the productivity in construction.

In particular, some local small and medium-sized companies take noteworthy efforts based on their own issues.

The construction industry is definitely moving, now. We should excite this movement and turn construction into a vibrant industry.

Thank you for your kind attention