

EQ House

The Future of Our Architecture with AI and IoT

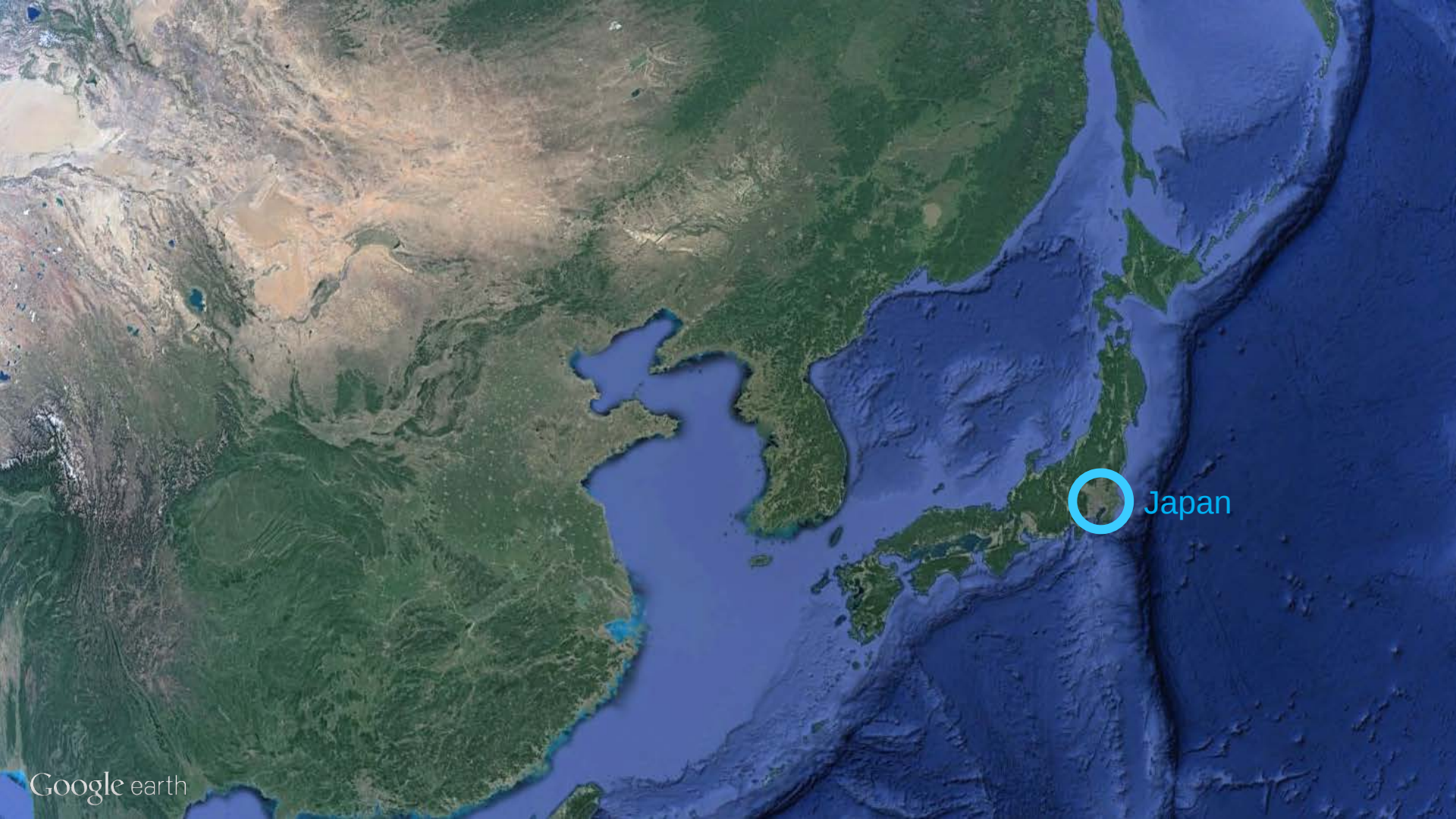
Ikuya Hanaoka

Advanced Design Group Leader
Takenaka Corporation

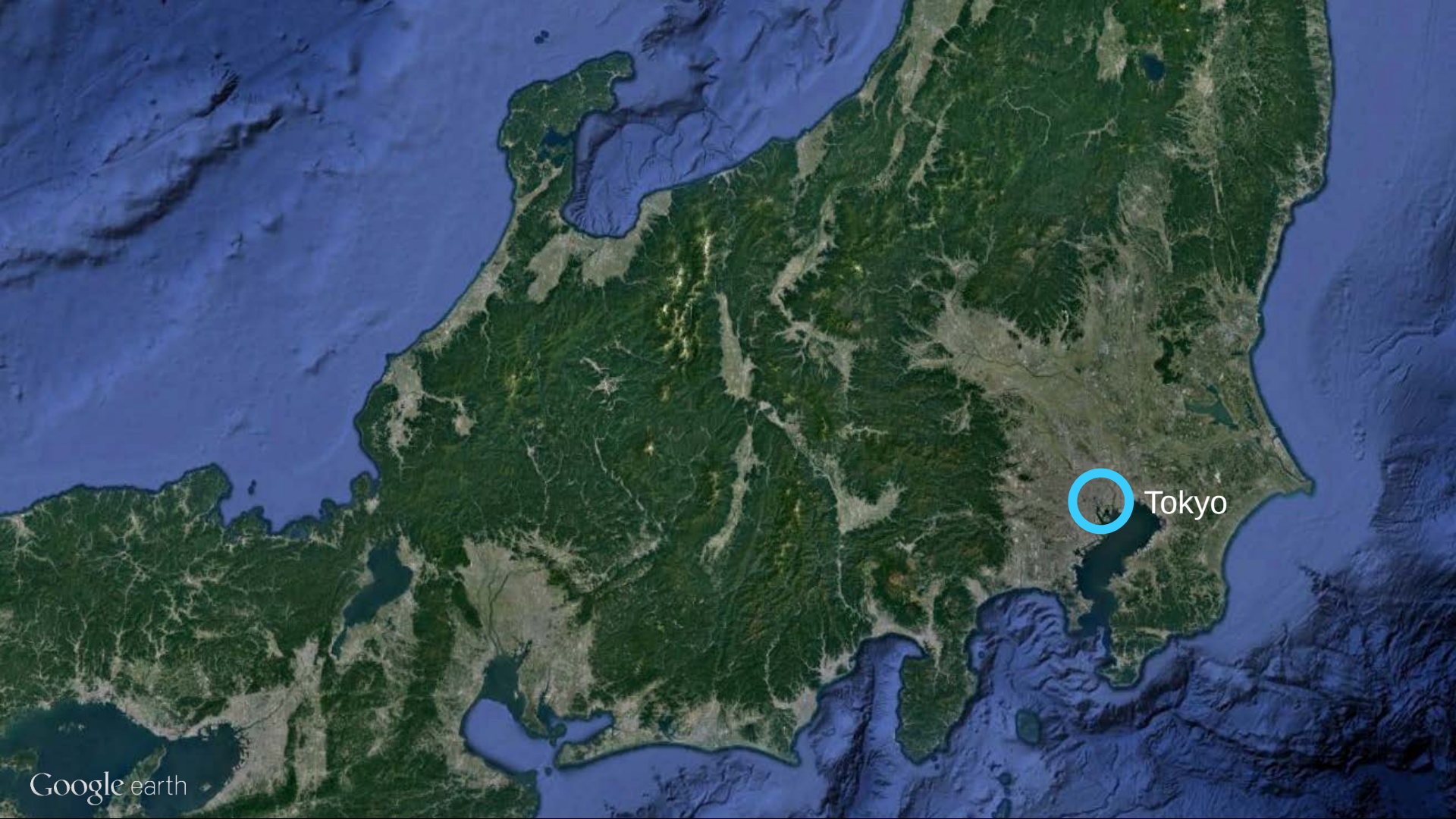


EQ House

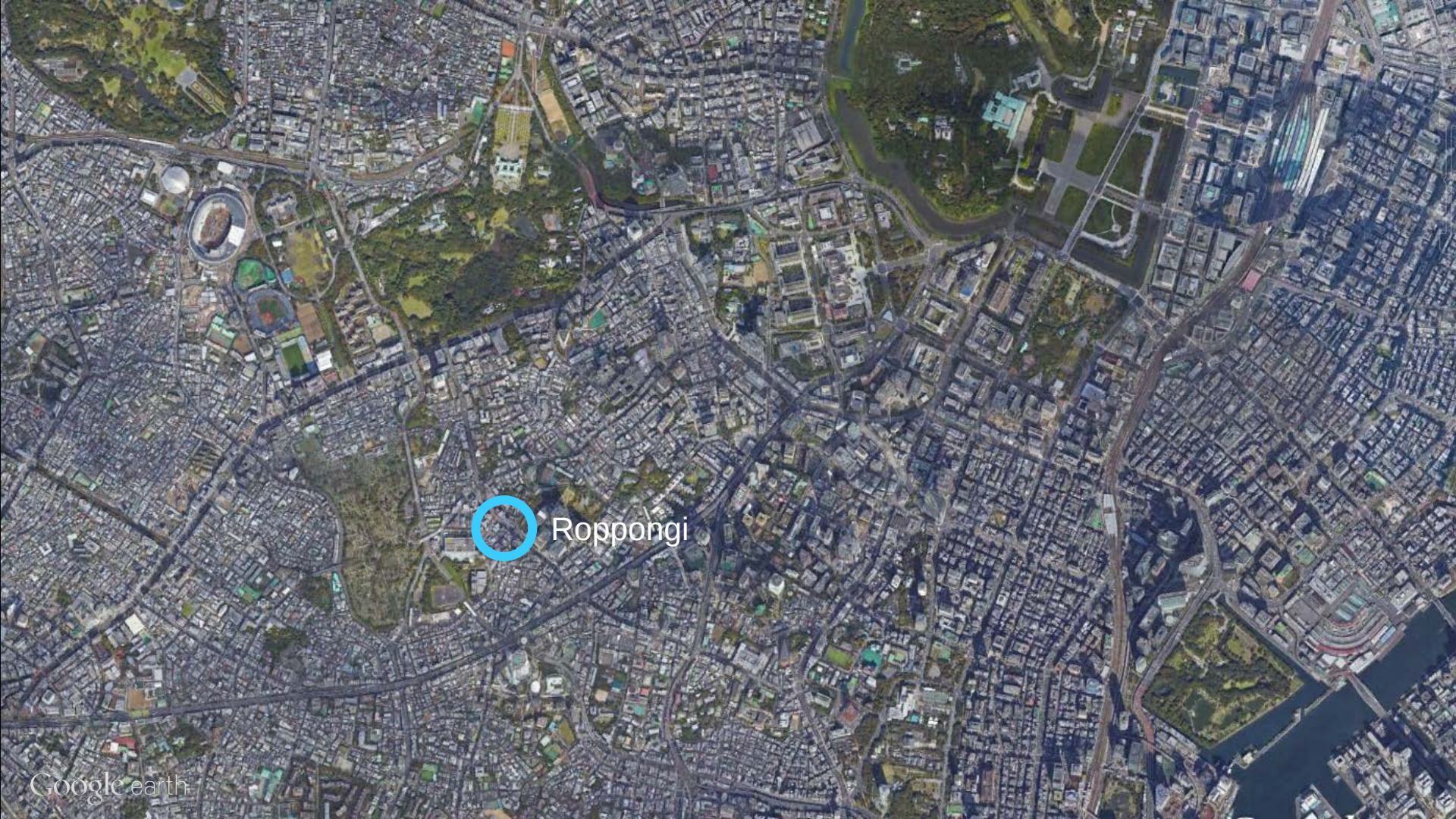




Japan



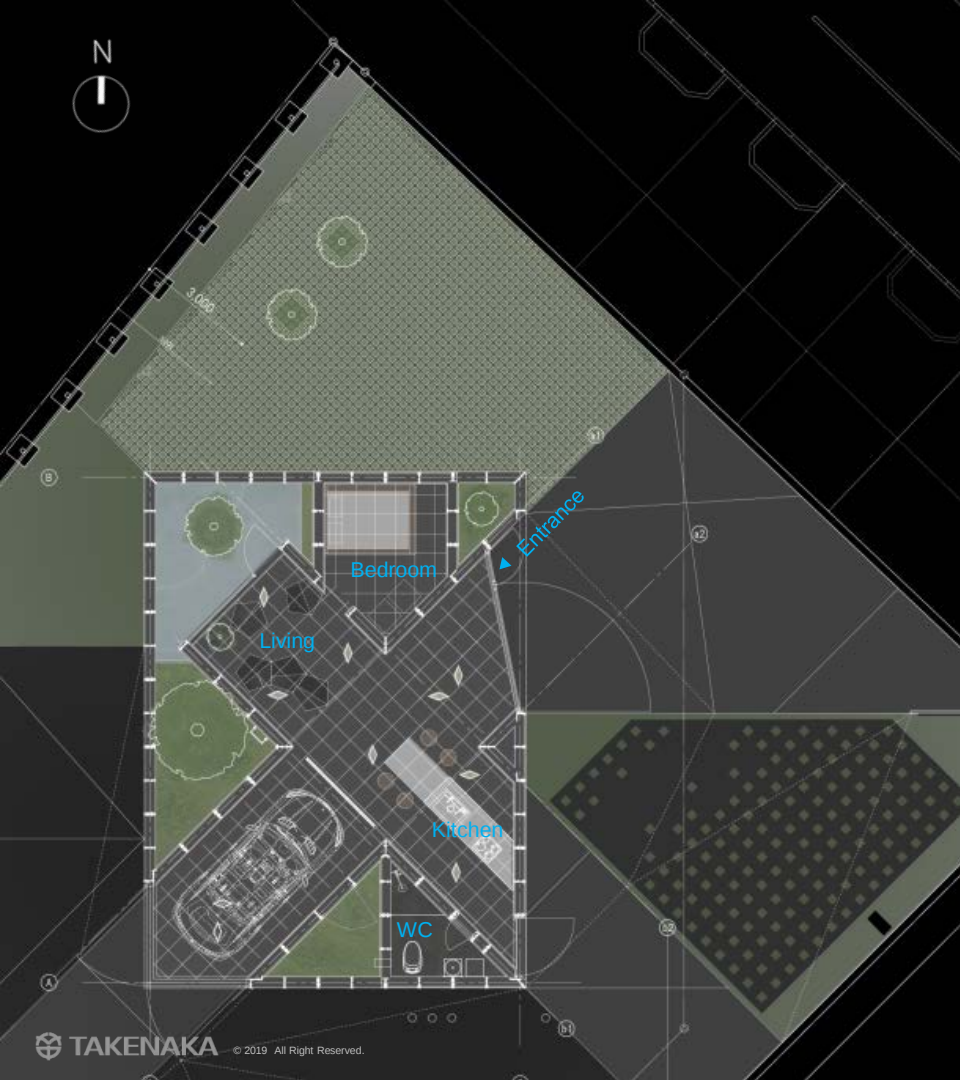
Tokyo



Roppongi



Site



Outline of the facility

Name	: EQ House
Building Site	: 7-3-10 Roppongi Minato-ku Tokyo
Main use	: Main／Show Space
	: Subordinate／Hotel
Site Area	: 493.90m ²
Building Area	: 120.69m ²
Total Floor Area	: 88.08m ²
Numbers of Stories	: 1 Story above ground
Maximum Height	: 8,308m
Structure	: S structure
Designing Period	: 2017.11.01～2018.08.31
Construction Period	: 2018.09.01～2019.03.01
Design and Construction	: Takenaka Corporation







01

Concept

The Mercedes-Benz EQ logo, consisting of the letters 'EQ' in a stylized, blue, sans-serif font. The 'E' and 'Q' are connected, with the 'Q' having a small tail that curves downwards.

EQ

Electric Intelligence
by Mercedes-Benz

01. Concept

FUTURE

MOBILITY × LIVING

01. Concept

CASE



Connected



Autonomous



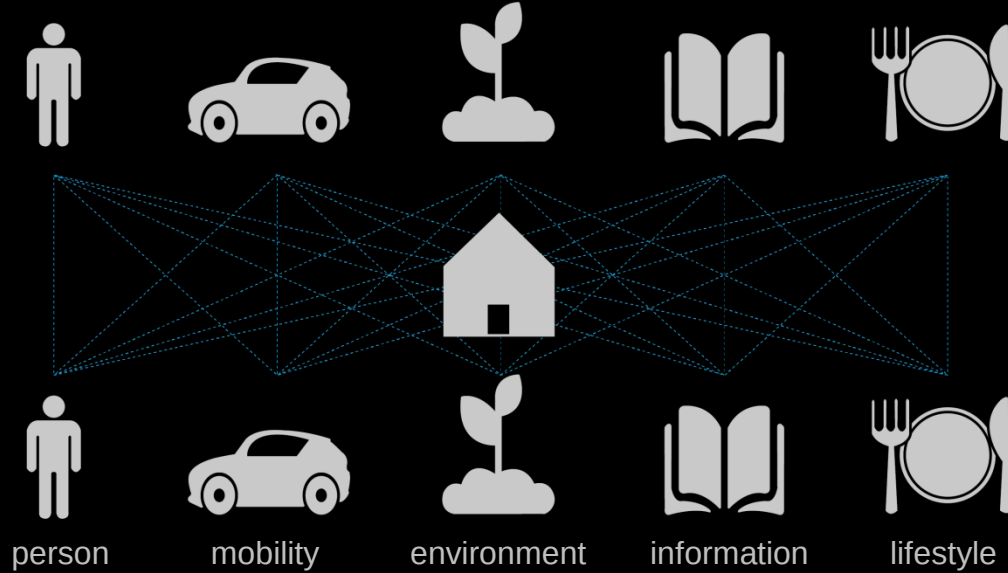
Shared & Services



Electric

01. Concept

share



connect

01. Concept

EQ House

For coming lifestyle and the space

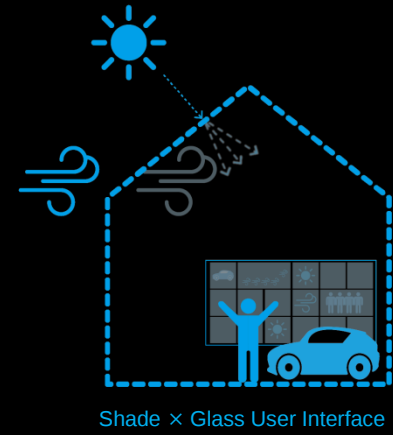
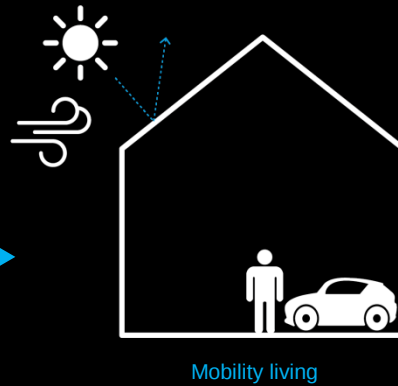
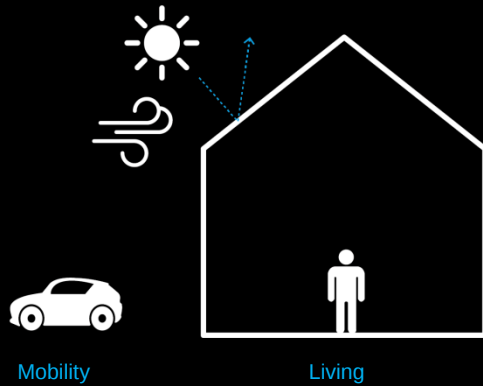
01. Concept

Personalize and Share



01. Concept

Overlap · Connect



01. Concept

Growing together with residents

「 Architecture Feels Alive 」

01. Concept

ARCHITECTURE + PHILIA

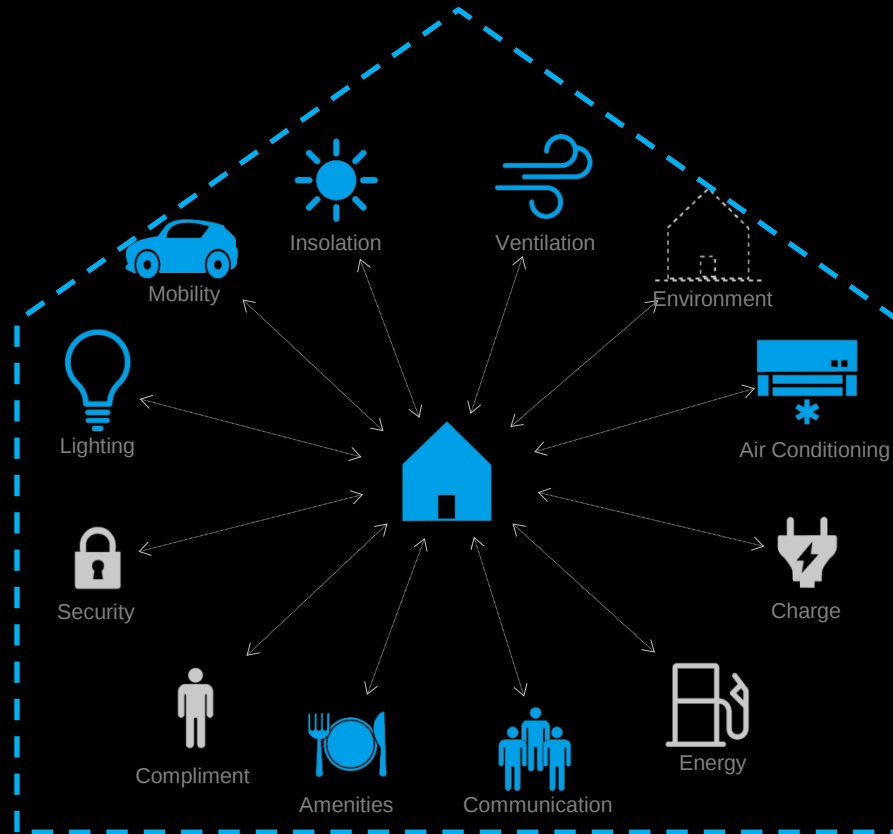
Archiphilia™

01. Concept

Archiphilia : In the near future IoT and future house shape

01. Concept

Connect
▼
Watch
▼
Communicate
▼
Learn
▼
Grow

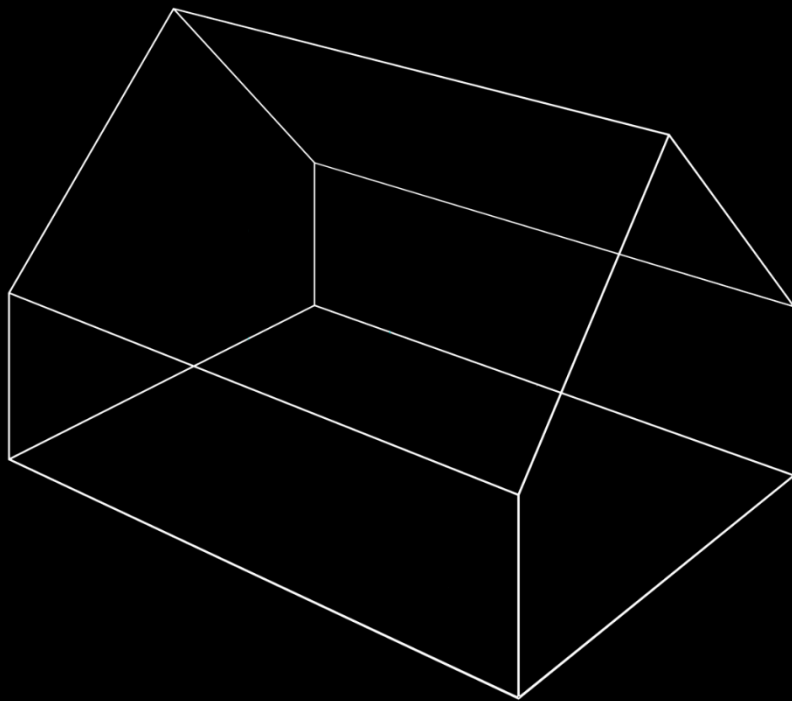


01. Concept

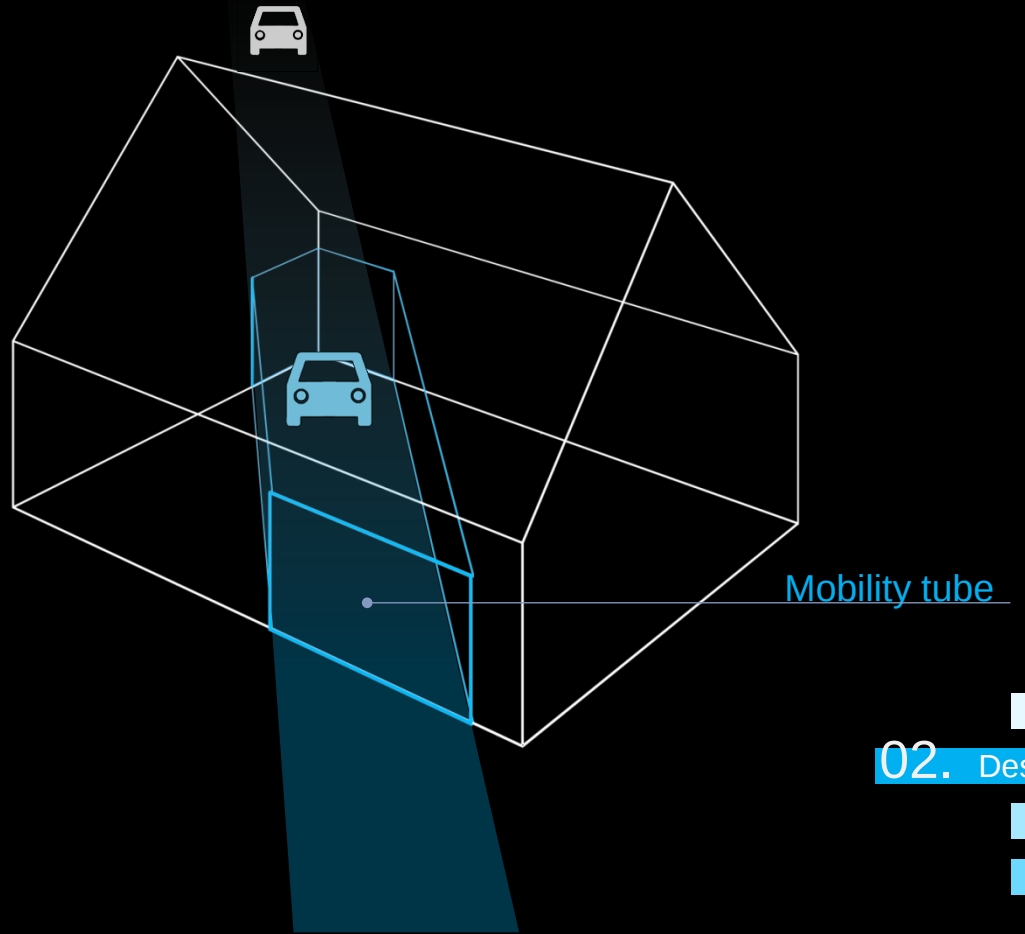
02

Design

The house becomes icon

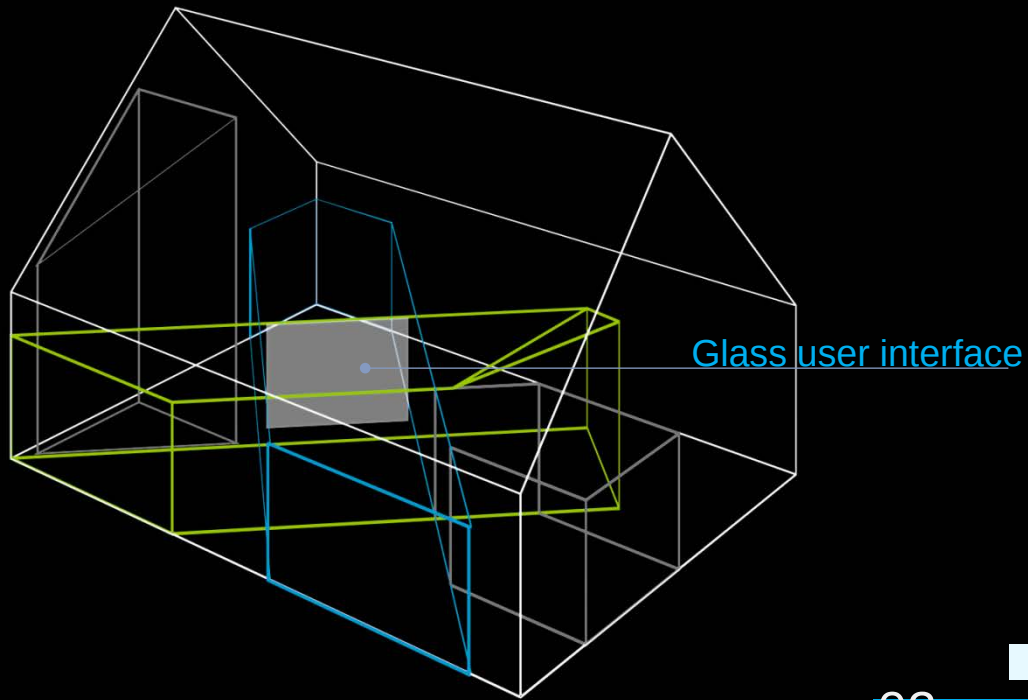


House accepts mobility



02. Design

Connecting livelihood and
information



02. Design

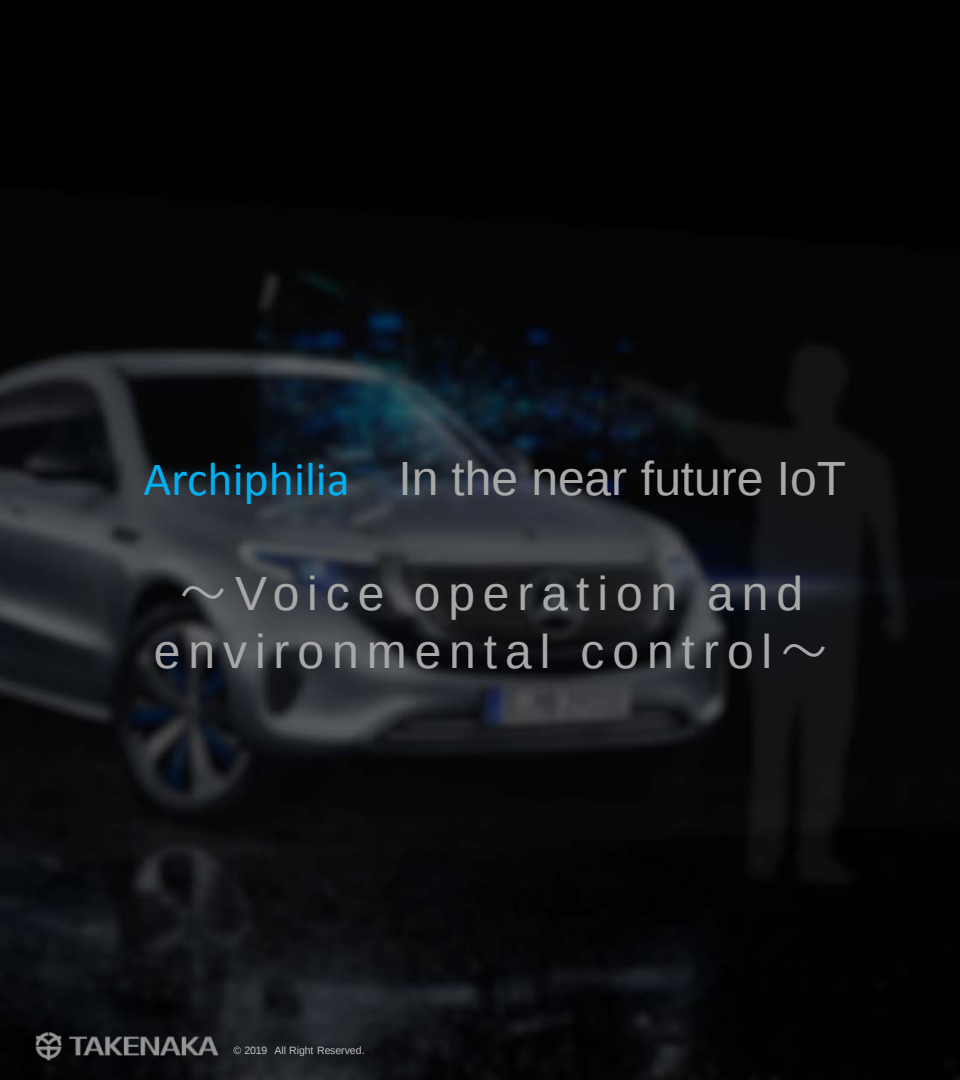


Archiphilia In the near future IoT

~Transparent interface with floating information~



02. Design



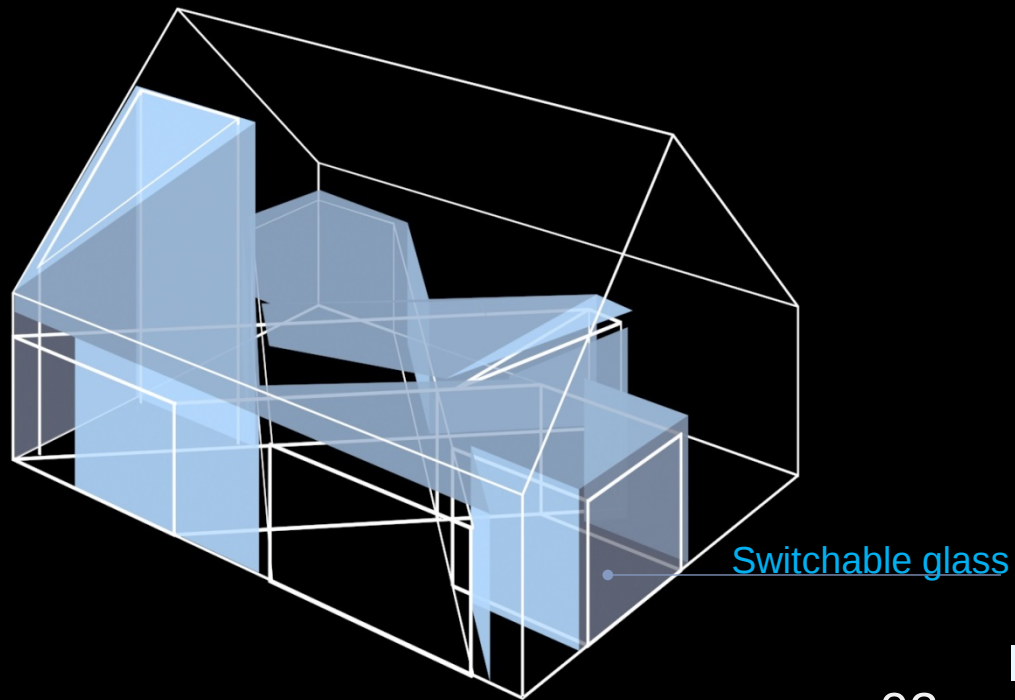
Archiphilia In the near future IoT

~Voice operation and
environmental control~



02. Design

React to residents and nature

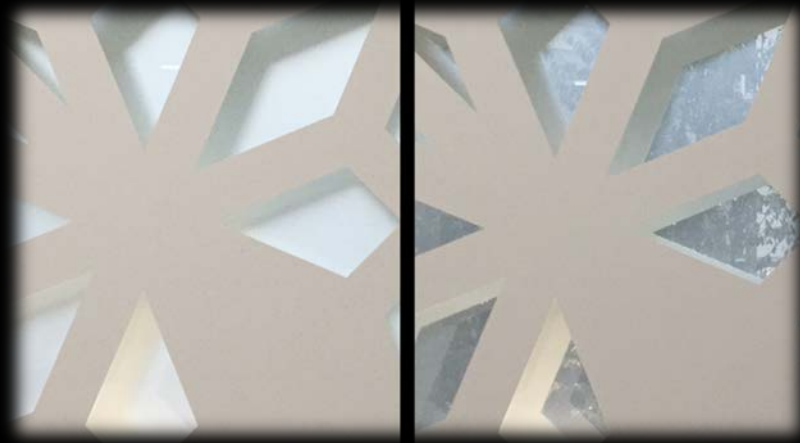


02. Design

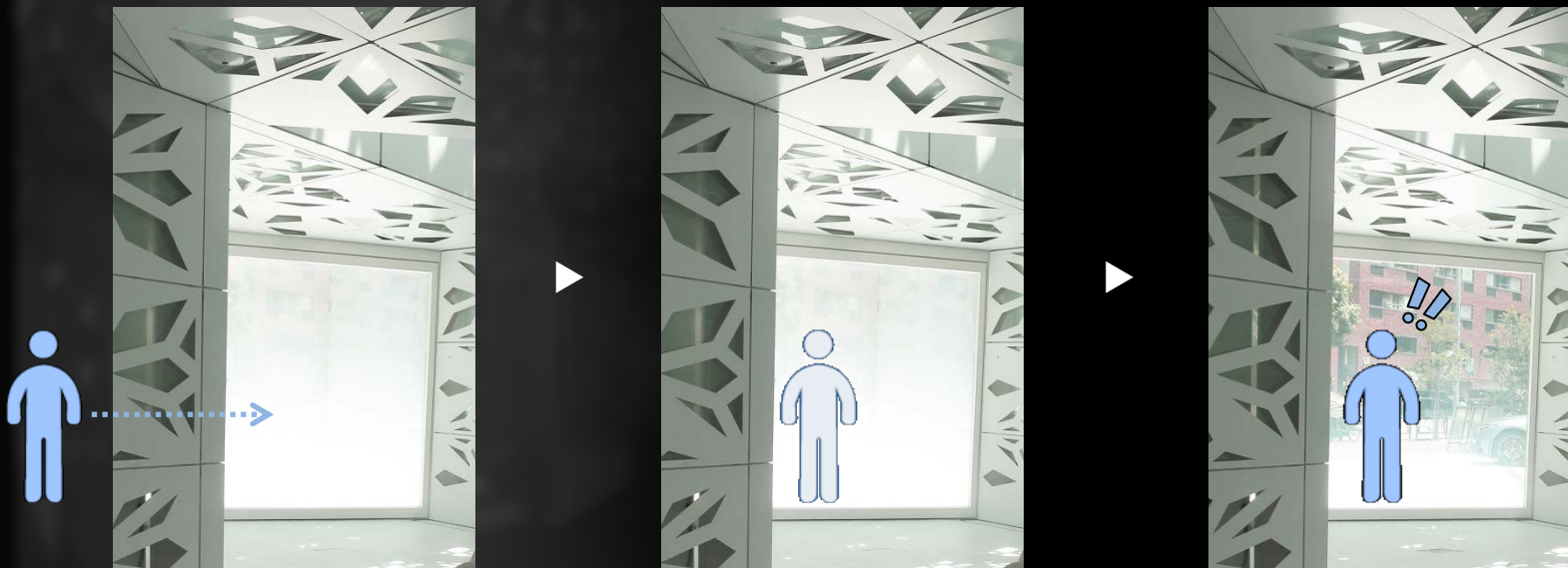


Archiphilia In the near future IoT

~Light control film responds to human movement and environment~

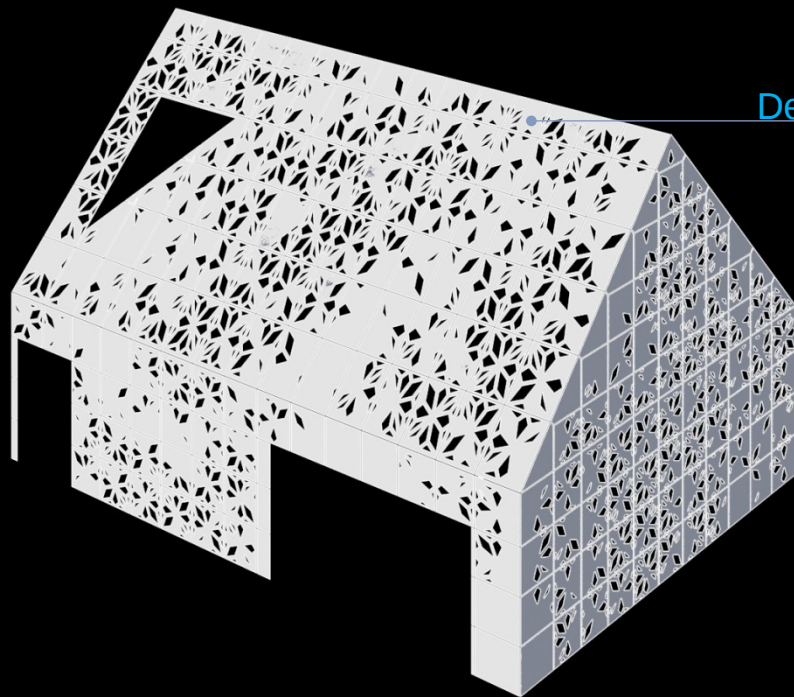


Light control film responds to human movement and exterior environment (sunlight shielding)



- The transparency of the light control film can be changed smoothly according to human movement.
- It changes according to human breathing and natural rhythm, and will be felt as if it is alive.

To connect residents and nature



Design pattern

02. Design

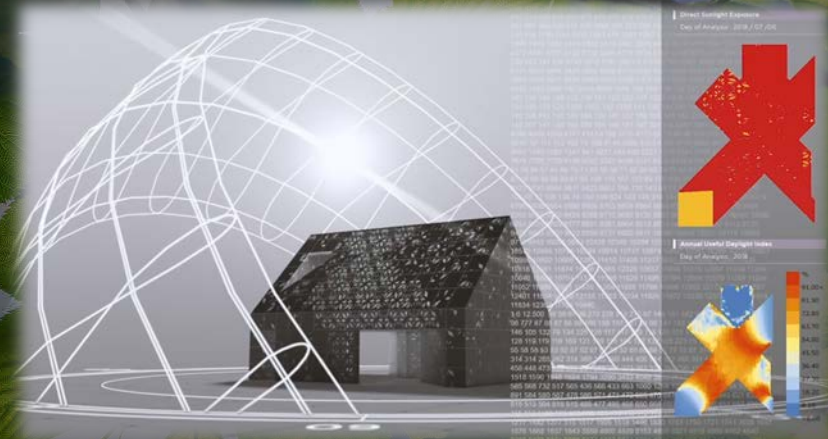
Archiphilia In the near future IoT

~Soft light like sunlight filtering down through
the trees~

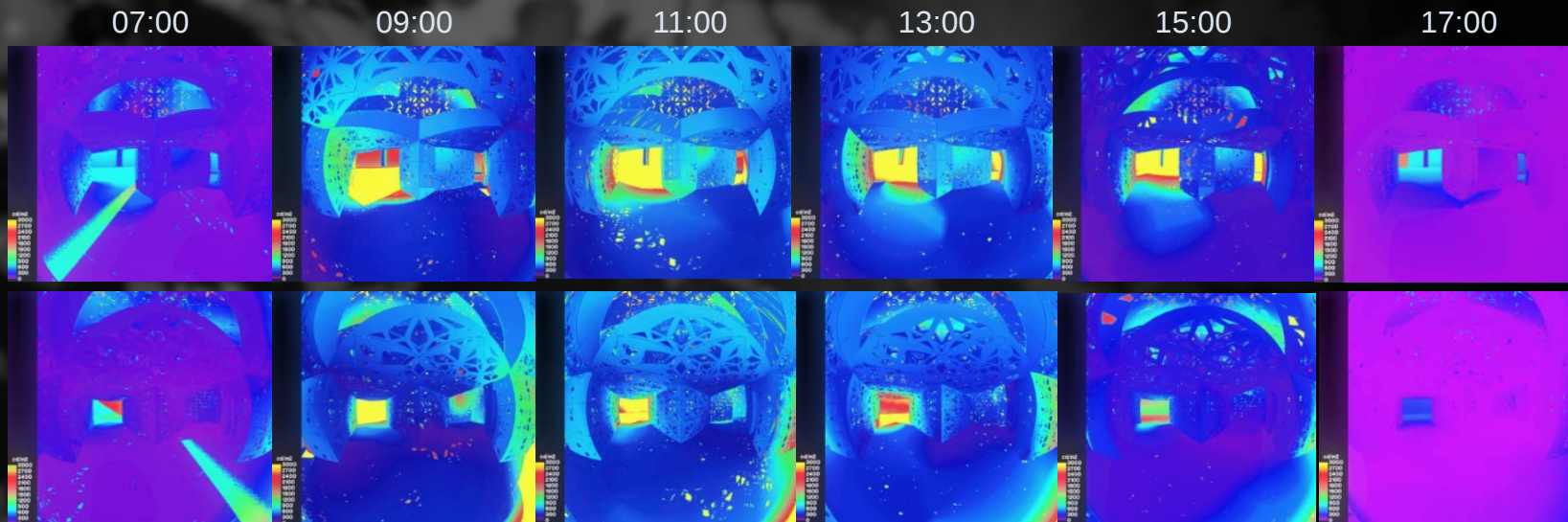


02. Design

Archiphilia In the near future IoT
~Algorithm to achieve soft light~



Light control film in response to residents movement and external environment (sunlight shielding)



The simulation of a shadow patterns to change vary from hour to hour.

02. Design

To fulfill the solar insolation shielding control hybrid real (sensor measurement results) and VR (simulation).

03

03 | IoT and AI

Growing together with residents

「 Architecture feels alive」

03. IoT and AI

Archiphilia™

Growing together with residents

~ as part of nature ~

~ feels alive ~

Connect



Watch



Communicate

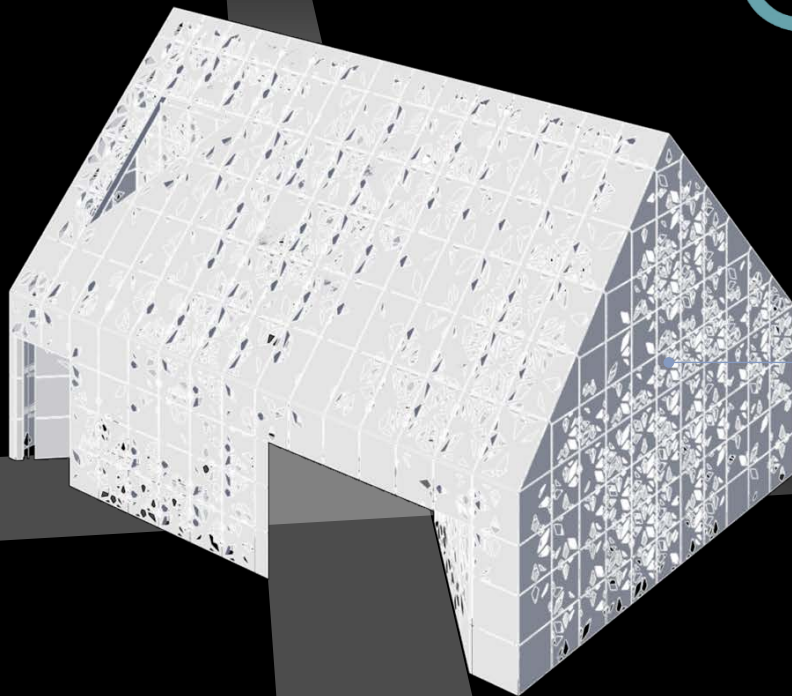


Learn



Grow

House learns and grow



AI

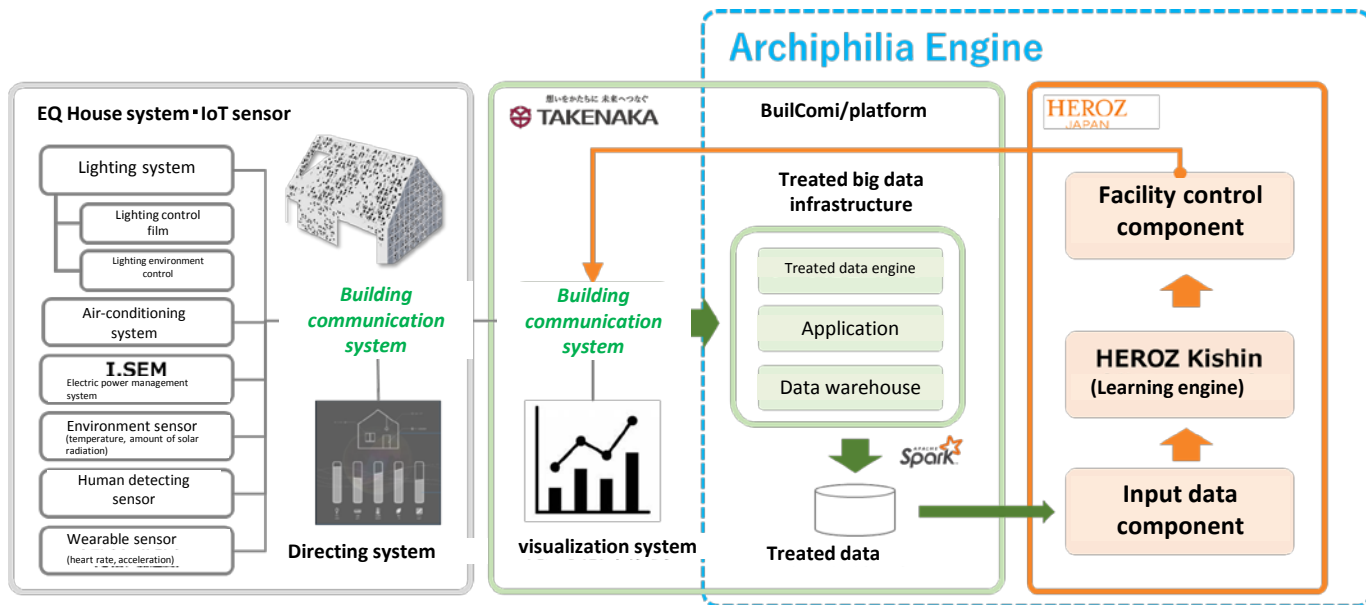
Archiphilia In near future IoT

~Sensing of hidden background and
evaluation • learning~



03. IoT and AI

Connects everything to enables free control of information infrastructure



→ Bring 「Growing architecture」 into reality

- Leverage the strength of high scalability and high degree of freedom of building communication system to connect AI, IoT sensor and control system to realize "go on in life architecture" .

04

DIGITAL DESING BUILD



EQ House

Achieved through future designing
and construction technology



BIM × CLOUD

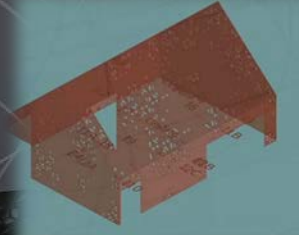


01. Concept

DIGITAL DESIGN BUILD

~Programmatically generated configuration~

Isometric Projection



Direct Sunlight Exposure



Direct Sunlight Exposure

Day of Analysis 2018 / 07 / 06



Isometric Projection



Direct Sunlight Exposure



Isometric Projection



Direct Sunlight Exposure



Isometric Projection



Direct Sunlight Exposure



Isometric Projection



Direct Sunlight Exposure

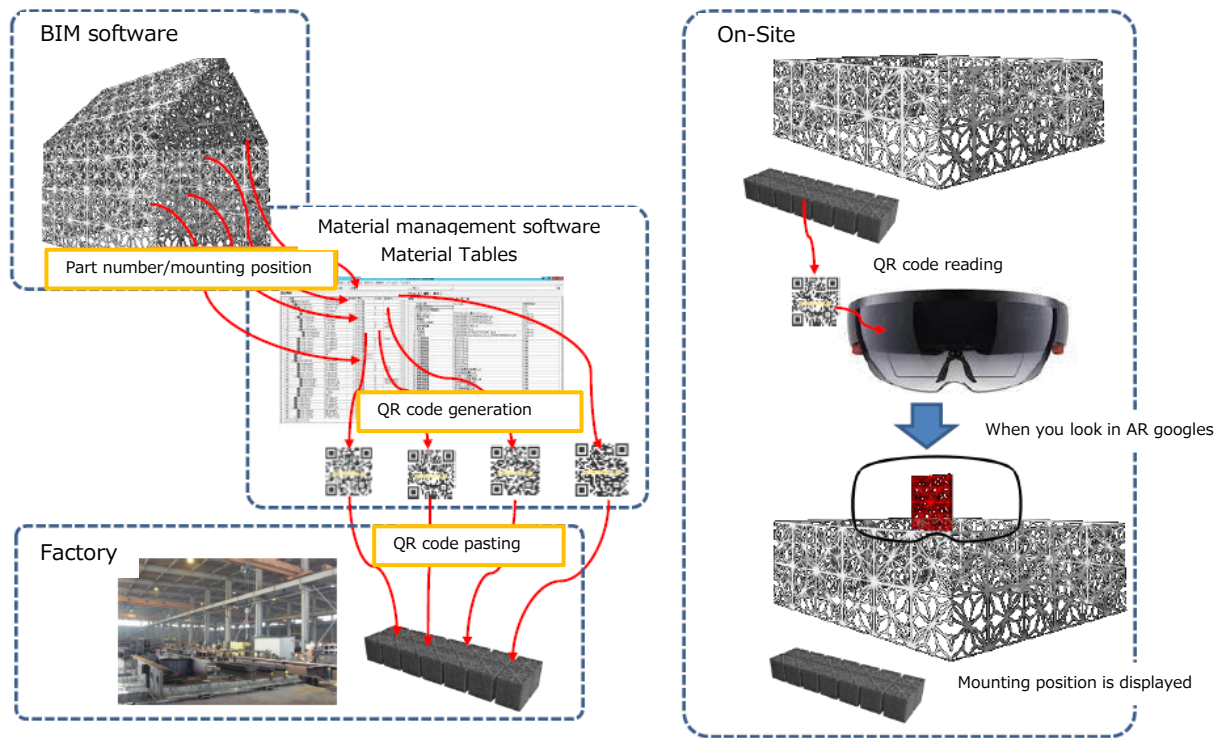


DIGITAL DESIGN BUILD

~Improving construction efficiency with digital data~

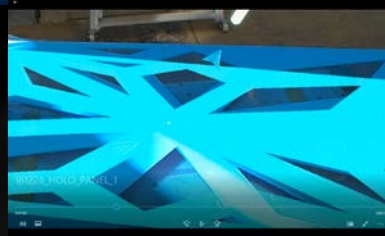


Digital design & build



HoloLens guides the installation position of complex parts

Microsoft
HoloLens



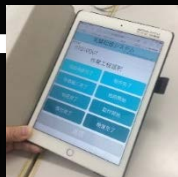
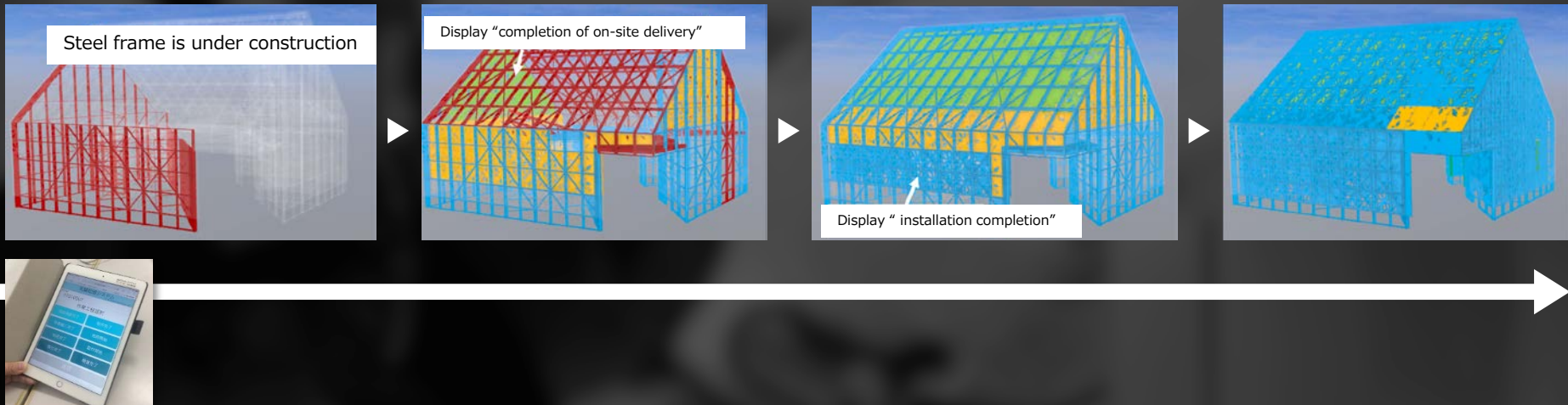
Developed an application that guides where 1200 panels are installed.



DIGITAL DESIGN BUILD

～Smart and accurate construction using MR～

Digitalization of process flow management



Result

- Realization of real-time visualization by digitalization of construction progress
- Possibility to use as necessary piecework information by adjust an account with a specialist construction company.

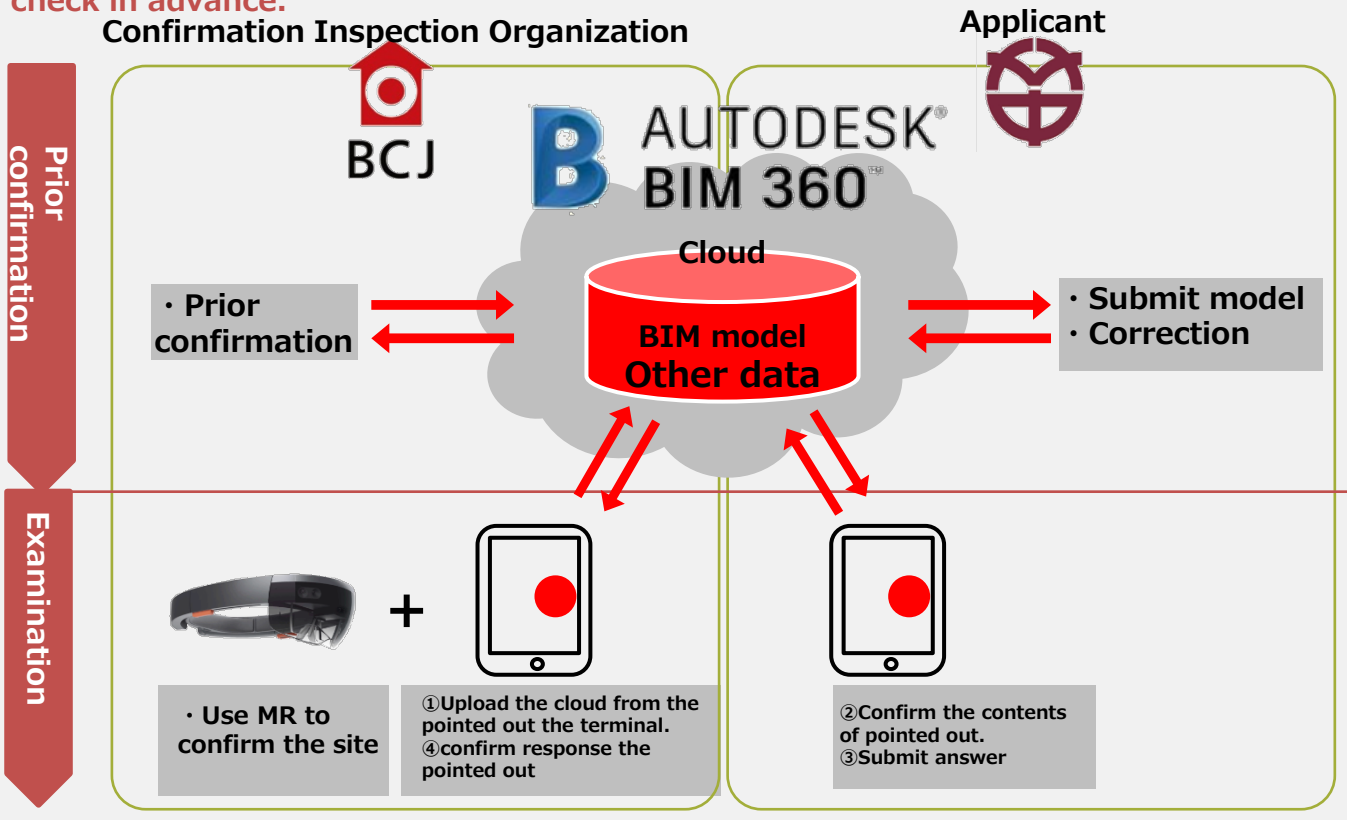
Task

- Recording effort in an issue, and it is difficult to realization.

3D Application, using HoloLens to interim examination

- inspected

Share models in the cloud environment and check in advance.



3D Application, using HoloLens to interim examination

- inspected



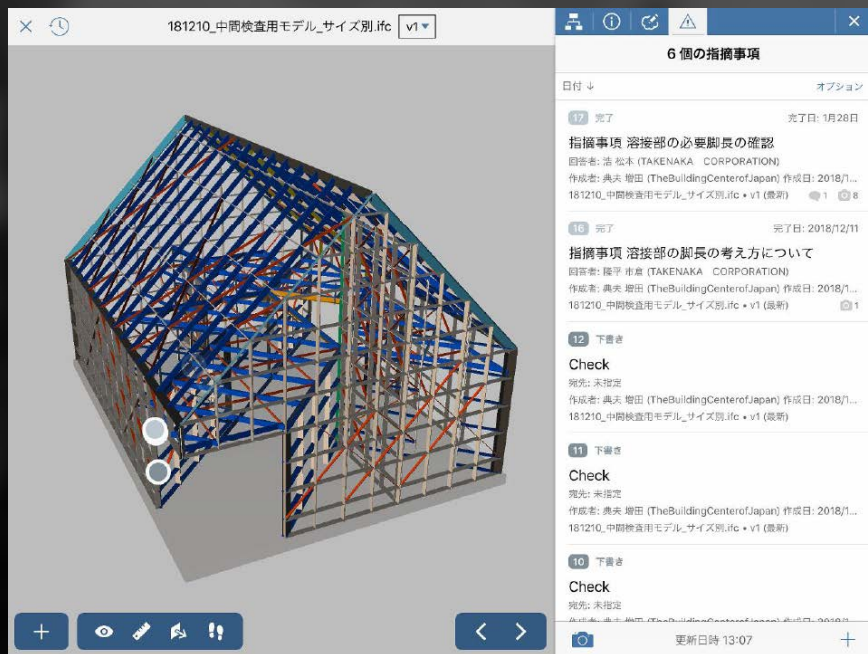
Checking the shape of the joint



Checking steel material types

Inspected (December 11th implementation status)

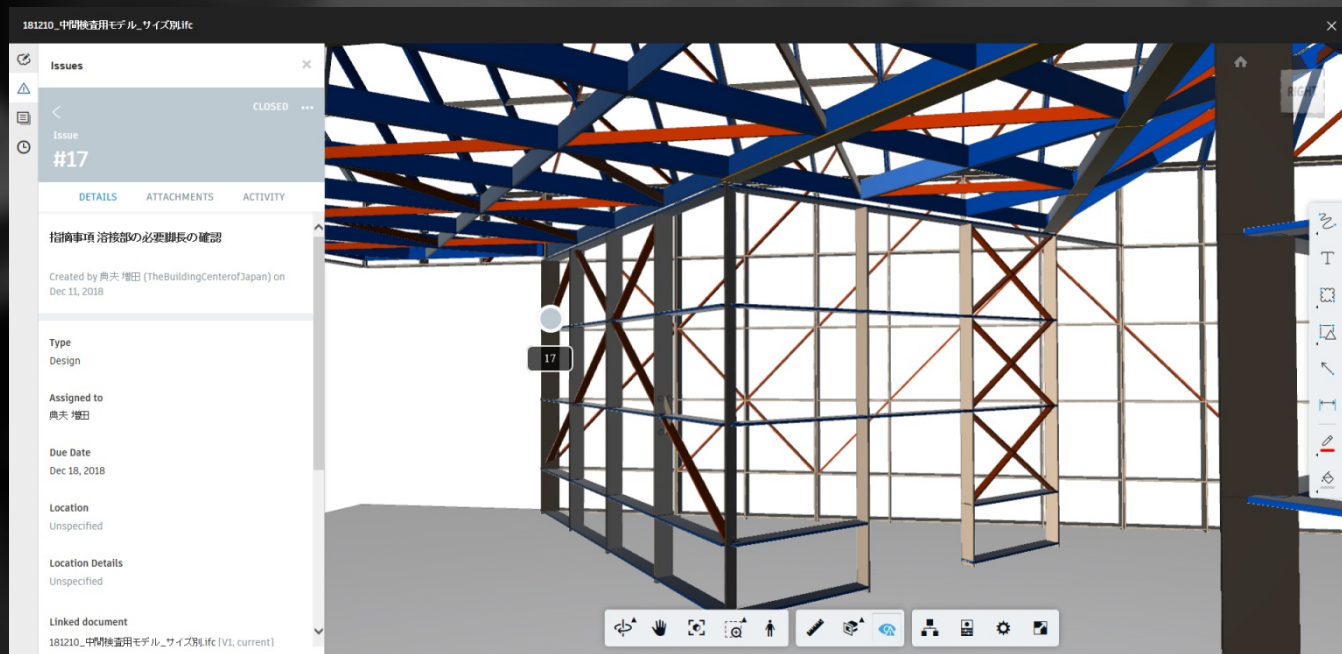
3D Application, using HoloLens to interim examination ・inspected



Inspected (February 21st implementation status)

Using HoloLens (Division line, inclusion range, piping type, etc.) and over layer the actual things with the functional layer to inspection.

3D Application, using HoloLens to interim examination ・ inspected



Inspected (February 21st implementation status)

Using HoloLens (Division line, inclusion range, piping type, etc.) and over layer the actual things with the functional layer to inspection.

3D Application, using HoloLens to interim examination ・inspected



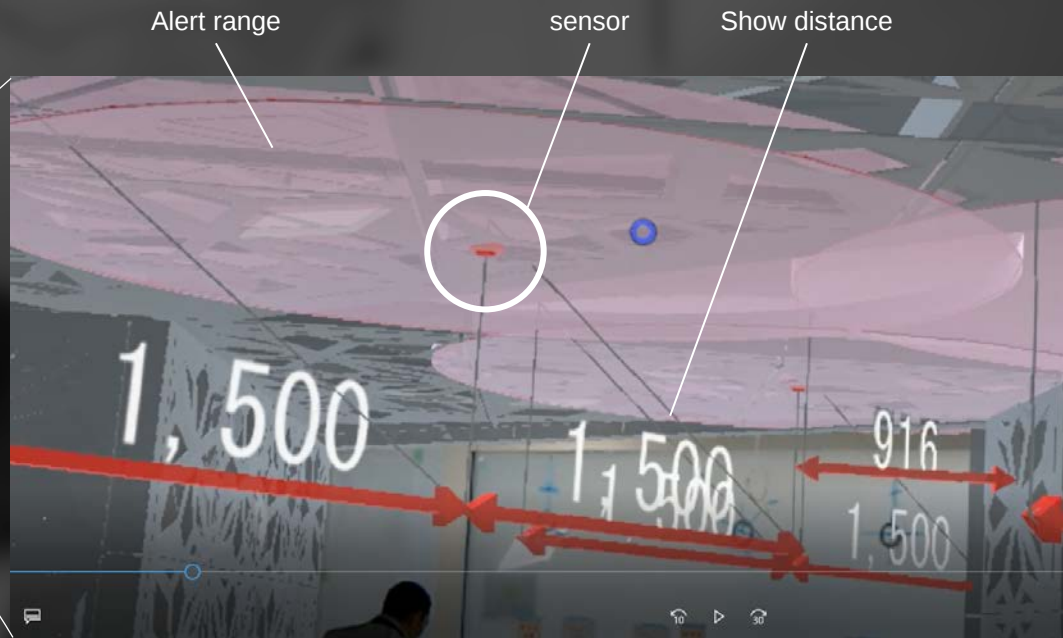
Inspected (February 21st implementation status)

Using HoloLens (Division line, inclusion range, piping type, etc.) and over layer the actual things with the functional layer to inspection.

3D Application, using HoloLens to interim examination • inspected



Projecting what you see on the head mounted display on a large screen → sharing information with other.



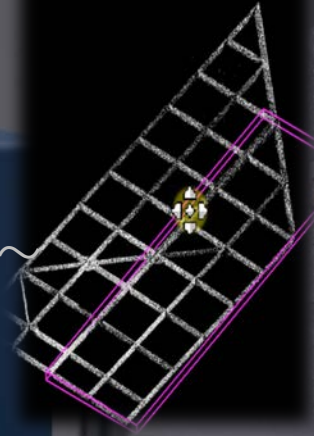
Sensor and warning range model

Inspected (February 21st implementation status)

Using HoloLens (Division line, inclusion range, piping type, etc.) and over layer the actual things with the functional layer to inspection.

DIGITAL DESIGN BUILD

~3D scanning for construction management~



Example of product inspection utilization in steel factory

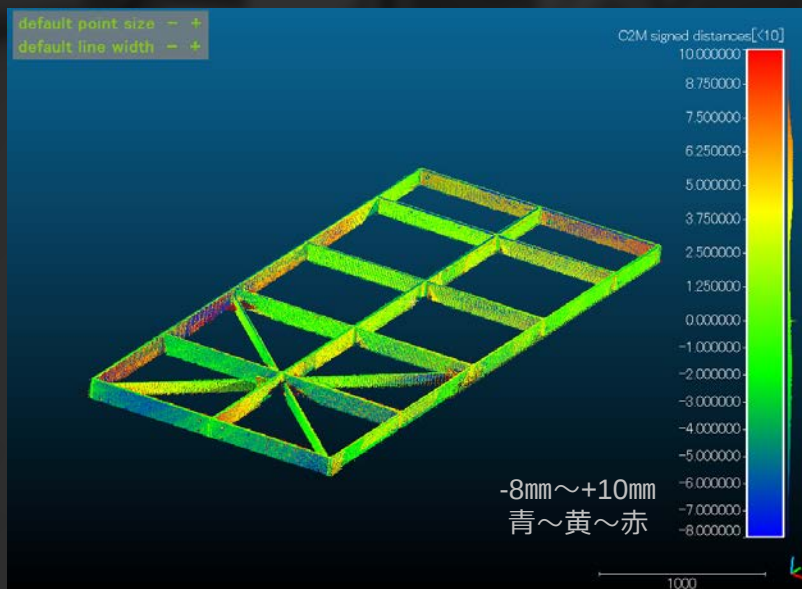


3D scanning at a steel factory

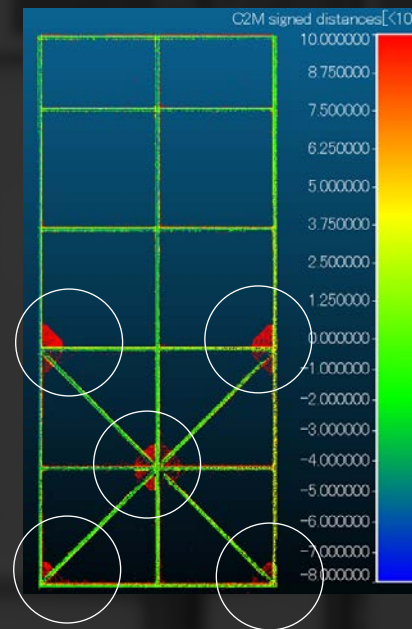
Usually worker will do the measurement using scales $\Rightarrow$ Digital and efficient

Example of product inspection utilization in steel factory

Example 1 | Calculation of manufacturing accuracy



Example 2 | Extraction of parts that differ from the design BIM model

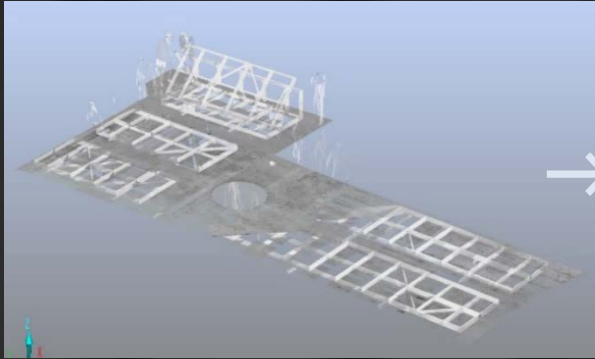


Differences of color coding of the steel frame BIM model
between point cloud after factory production and design phase .

- © Imager5016 with less point cloud noise
- △ Measurement speed including lead time for installation and transportation is an issue
- △ Reducing lead time from measurement to data output is an issue

Digitize factory-manufactured products and inspect them in virtual space.

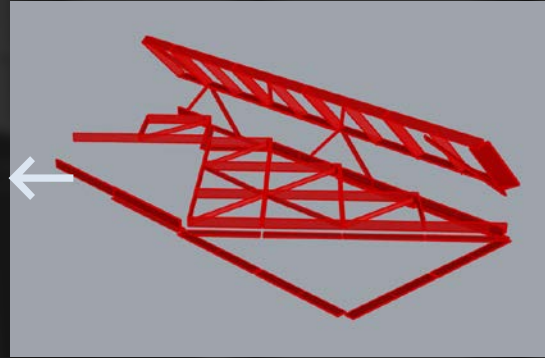
Example 3 | Digital inspection by shape comparison



Implementation data (3D scan data)



Imaginary trial
assembling



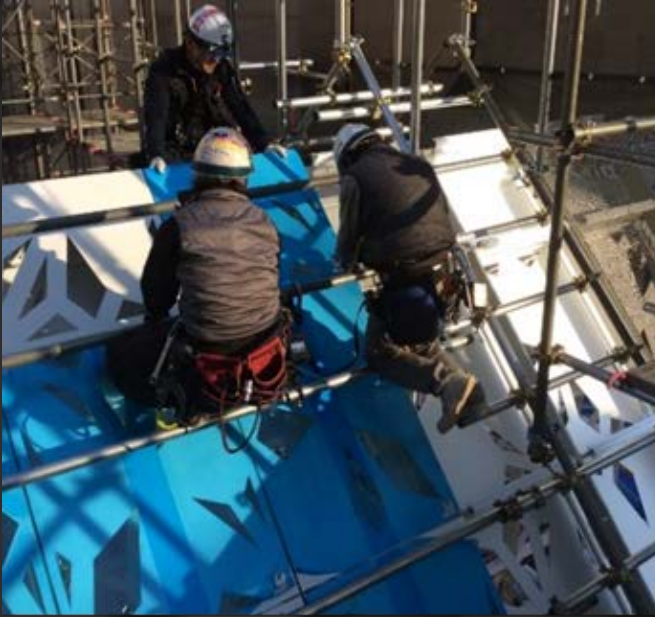
Design data (BIM model)



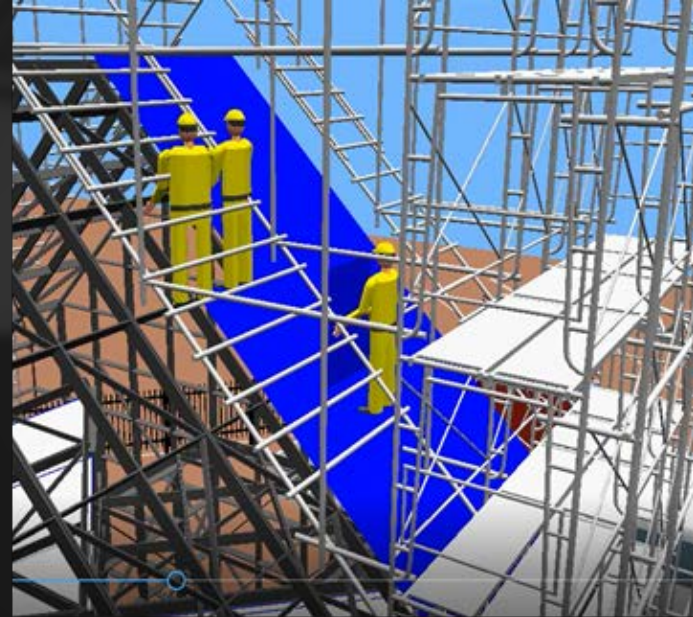
The actual temporary
steel frame can be omitted

Trial of virtual temporary assembly by superimposing plan data (BIM model) and execution data (3D scan data) for the purpose of omitting temporary assembly in steel construction

Labor and work procedures



Actual work

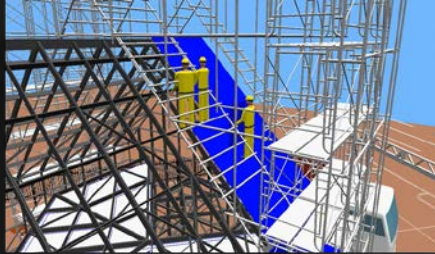


Reproduced work

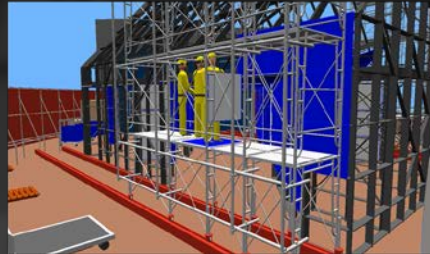
Multi-agent simulation tool that can be simulated in 3D space considering the characteristics of construction work
(Previously used for line design in the manufacturing industry)

Labor and work procedures

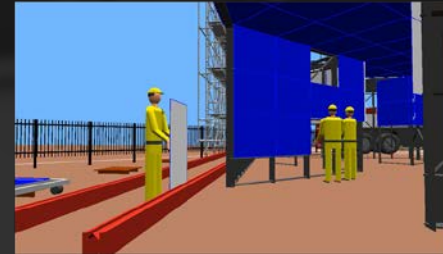
Reproduced work view



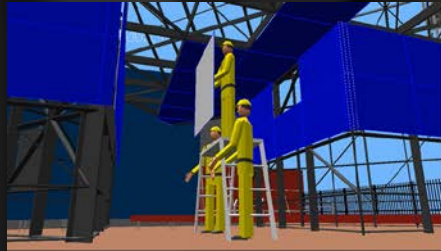
Sunshade part



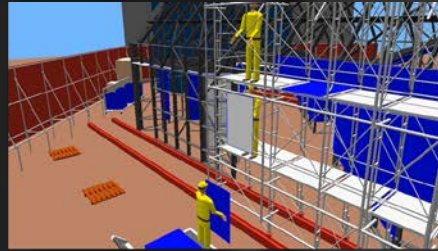
Exterior part



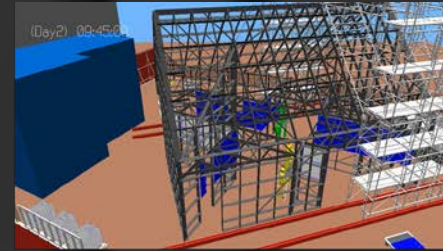
Interior part



Ceiling part



Panel lifting work



Multiple section composition

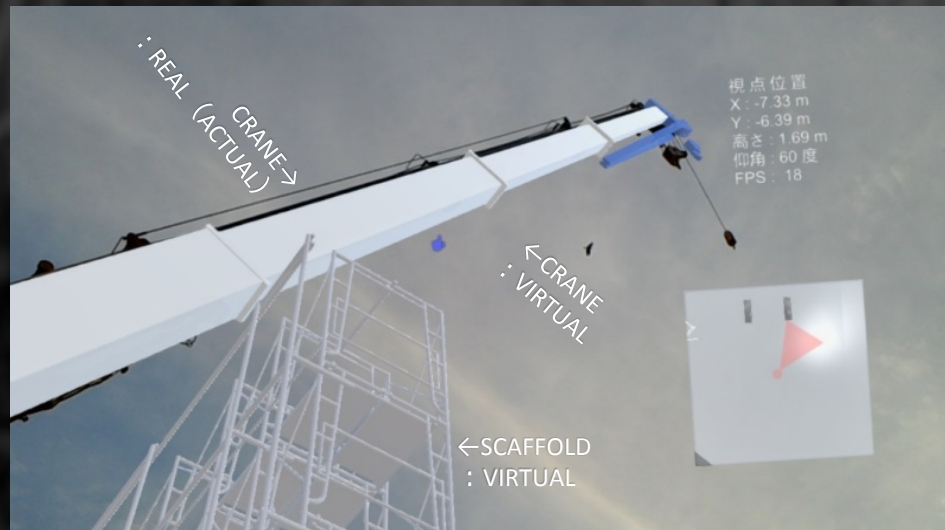
Result: Digitally recording labor and work procedures in form can be reproduced even if the conditions have changed

Task: Initial input, the difficult adjustment due to parameter setting take a lot of trouble in practice.

Necessary to input automated technique.

Advanced construction management through MR

Microsoft
HoloLens



Project steel frame construction and heavy machinery layout for the next day

Implementation of digital KY sharing the image with the foreman of each major work type

Using a BIM model with provisional design steps, 4D-MR can be viewed over HoloLens, and the validity of the construction plan and preliminary examinations can be verified with reality.

DIGITAL DESIGN BUILD

～Automation o work using robots～

Combined utilization of hololens, assist suits, IoT device and automated transport

IPHONE
APPLE WATCH

HOLOLENS

ASIST SUITS
(ATOUN MODEL-Y)



Lighter handling work with assist suits



The latest model is developed and sold for the purpose of reducing the burden on the waist.

DESIGN

BUILD

Architecture desired by customers

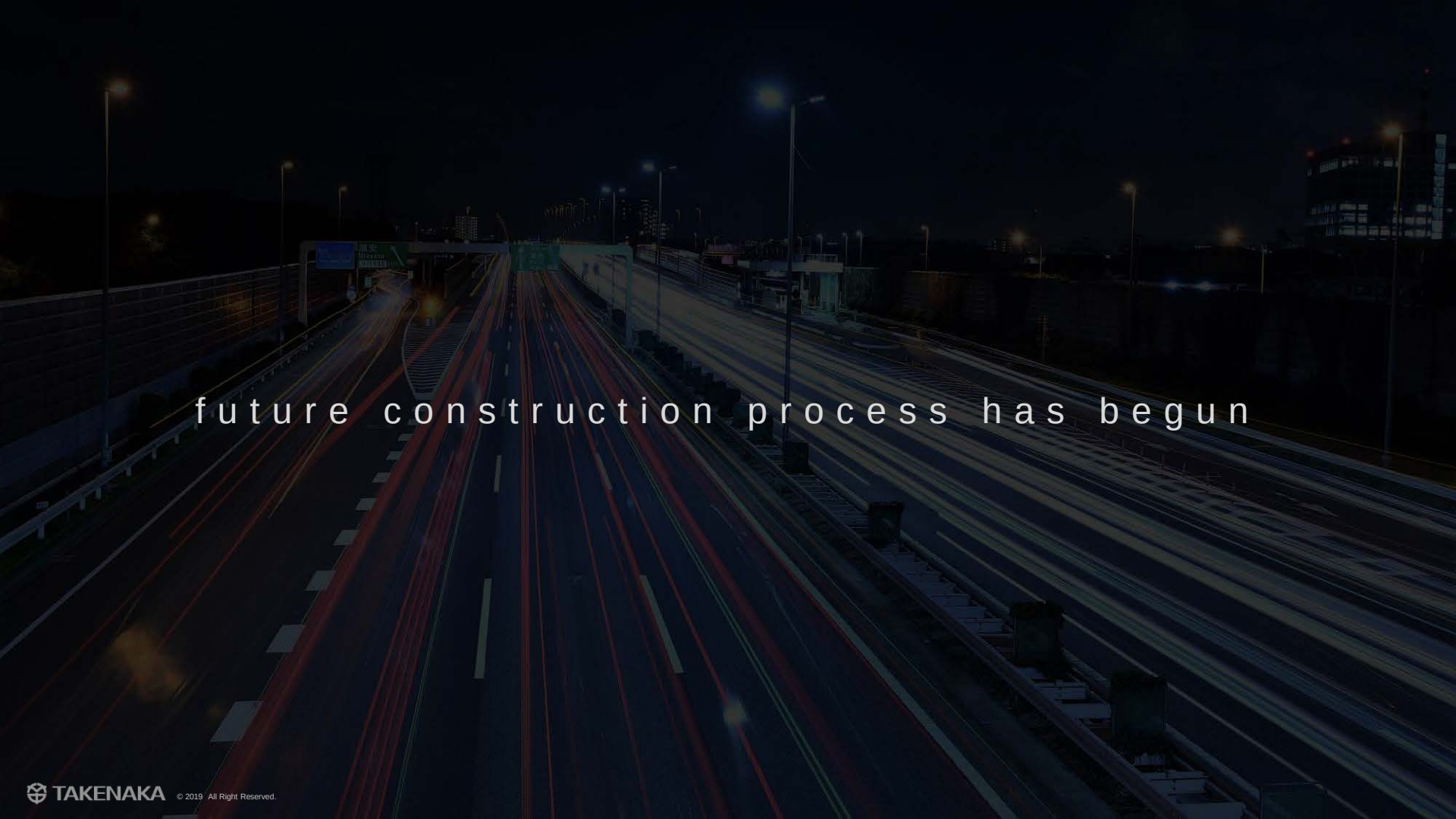
Responding to diversification and complexity

Solution using digital technology

Labor shortage

Reduce workers and skilled technicians

DIGITAL DESIGN BUILD



future construction process has begun

LINK : Concept movie

Thank you !

www.linkedin.com/in/ikuya-hanaoka