

# CIRCULAR DESIGN BUILD

## vol.1 CONCEPT BOOK



**Circular Friends – Join Us!**

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please contact us here.



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font is used for captions and figures.

# From Scrap and Build to Circular Design-Build

Leveraging our accumulated expertise and craftsmanship, Takenaka Corporation has long upheld a commitment to creating architectural works of enduring value.

Today, our society faces a wide range of challenges – the depletion of natural resources, waste generation, and greenhouse gas emissions, to name a few.

As the global community strives toward realizing a circular economy, Takenaka advocates for Circular Design-Build, a holistic approach to architecture that enables a truly circular society.

While preserving the spirit of craftsmanship that we have cherished for generations, we are moving beyond the conventional “scrap and build” model to create buildings where resources circulate continuously.

Our goal is not to choose between the present or the future, but to value both – building a sustainable society that nurtures today while safeguarding tomorrow.

## Societal Challenges



The urgent need for decarbonization



Environmental impact of resource extraction



Shortage of landfill sites



Rising material costs and inflation



Strengthening domestic distribution independent of imports

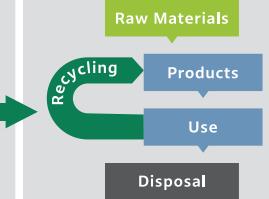
## What is a Circular Economy?

### Linear Economy



A traditional economic model based on the extraction of resources, mass production, mass consumption, and mass disposal.

### Recycling Economy



An improved model that reuses part of discarded resources to reduce waste and environmental impact.

### Circular Economy



A new economic model that aims to eliminate waste entirely by continuously circulating resources from a single initial input.

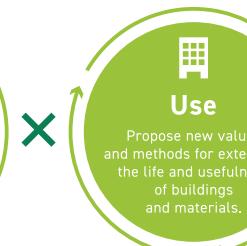
## A New Architectural and Construction Solution for a Circular Society

### Circular Design-Build



#### Make

Design, construction, and business activities that minimize resource consumption and generate zero waste.



#### Use

Propose new values and methods for extending the life and usefulness of buildings and materials.



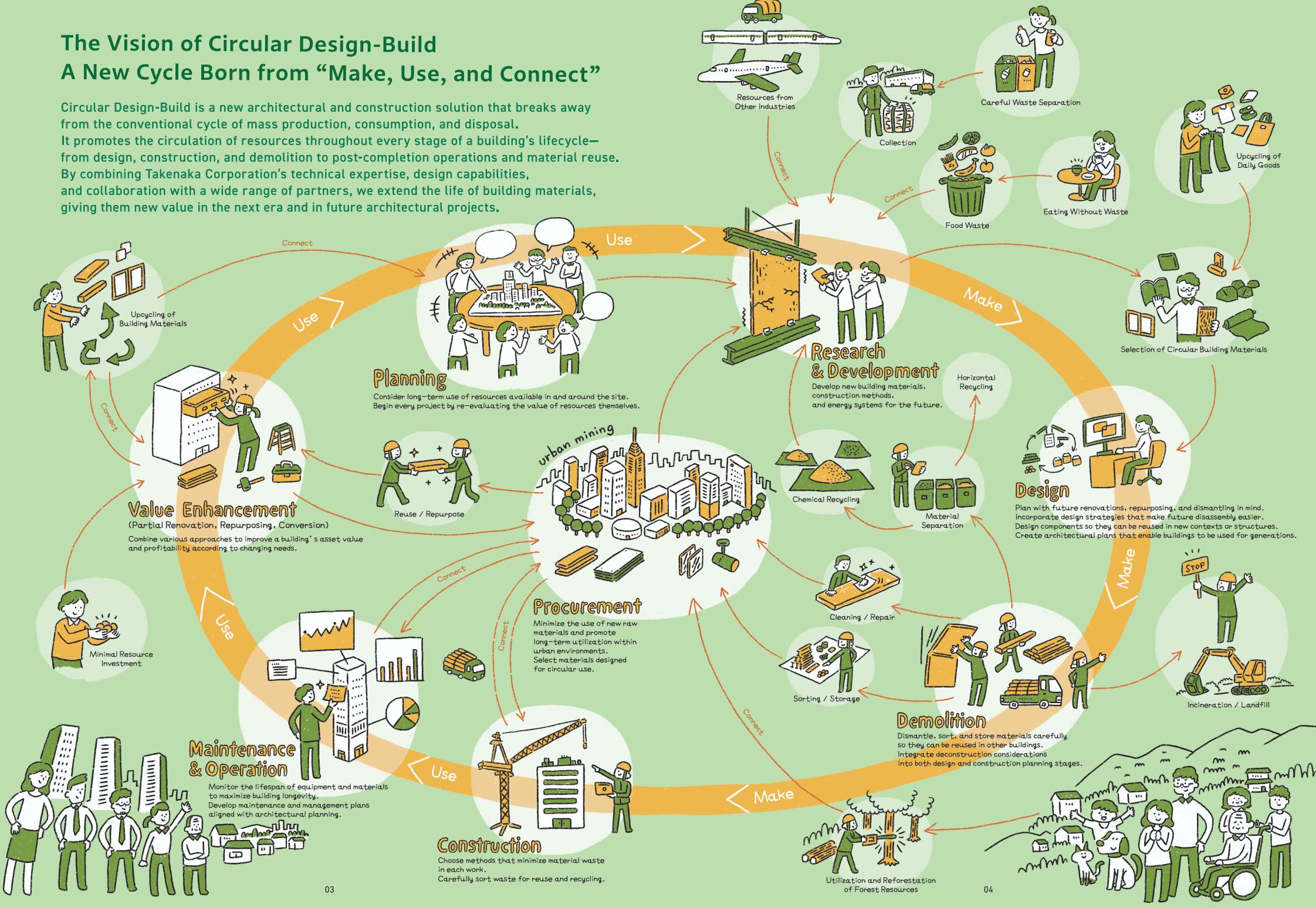
#### Connect

Link resources across industries and connect natural assets such as forests to community development.

# The Vision of Circular Design-Build

## A New Cycle Born from “Make, Use, and Connect”

Circular Design-Build is a new architectural and construction solution that breaks away from the conventional cycle of mass production, consumption, and disposal. It promotes the circulation of resources throughout every stage of a building's lifecycle—from design, construction, and demolition to post-completion operations and material reuse. By combining Takenaka Corporation's technical expertise, design capabilities, and collaboration with a wide range of partners, we extend the life of building materials, giving them new value in the next era and in future architectural projects.



# The Journey of Circular Design-Build

Osaka Lightning Protection &  
Earthing System Mfg. - Kobe Office  
Building Use: Office / Warehouse  
Total Floor Area: 471 m<sup>2</sup>  
Completion: 2024

DESIGN  
DEMOLITION  
VALUE ENHANCEMENT

Creating Value Through Time – Connecting by Reduction, Opening by Expansion



Exterior after renovation (Photo: Takuji Yamamoto)

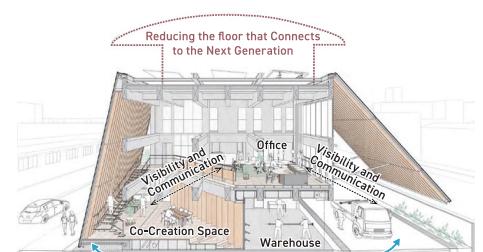
This project transforms a 35-year-old building into a new form while preserving its structural frame and exterior. Rather than demolishing and rebuilding—a scrap and build approach—our goal was to create new value by reinterpreting what already exists. In Japan, even today, it is common for buildings to be torn down after only a few decades, despite declining population trends. In this project, we sought value not in novelty, but in the character and presence that emerge over time. Our aim was to design architecture that continues to mature and become more beautiful as the years pass.



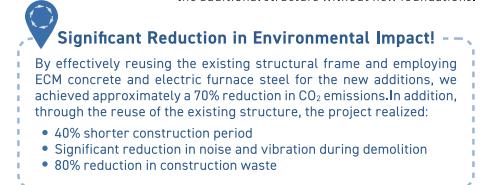
Interior of the former third-floor office.  
Blinds were kept closed at all times.



New office space with a double-height ceiling. The former third-floor doorway opening was reused as an air-conditioning outlet.  
(Photo: Yosuke Ohtake)



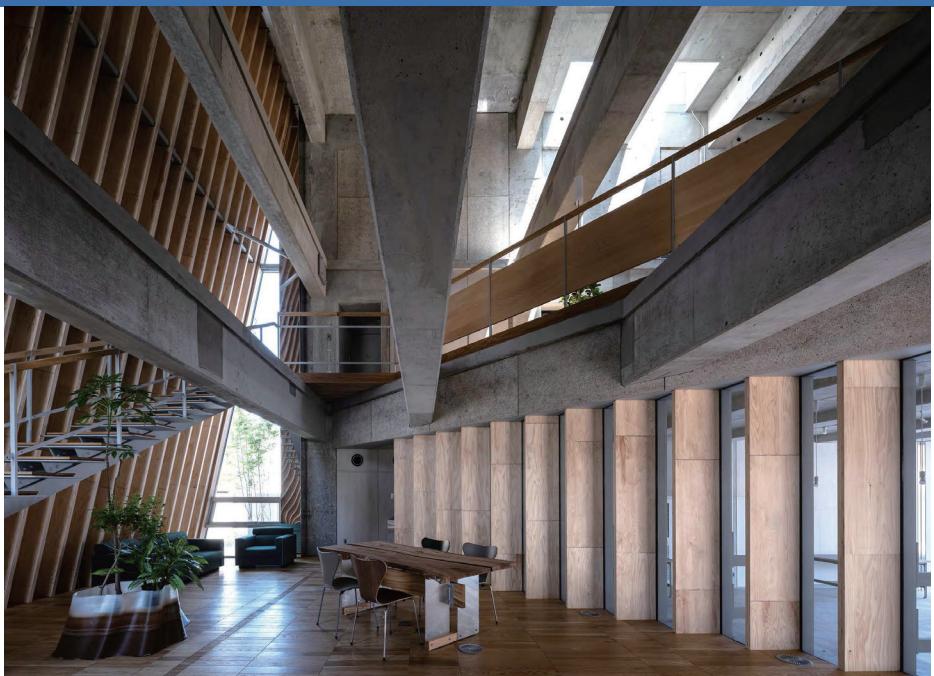
By removing part of the existing slab, saved weight realized the additional structure without new foundations.



## Takenaka Corporation, Osaka Main Office, Design Department



From left:  
 ● Kentaro Konomi  
Structural Engineering  
 ● Risa Yoshimoto  
MEP Engineering  
 ● Atsushi Yamazaki  
Architectural Design  
 ● Yukina Oishi  
Architectural Design  
 ● Tomonori Murakami  
Structural Engineering



The co-creation space between the warehouse/workshop and the second-floor office connects appropriately through the existing beam-retained atrium.



The second-floor office bathed in natural light streaming through the newly installed skylight



A two-story office with a ceiling height of two stories

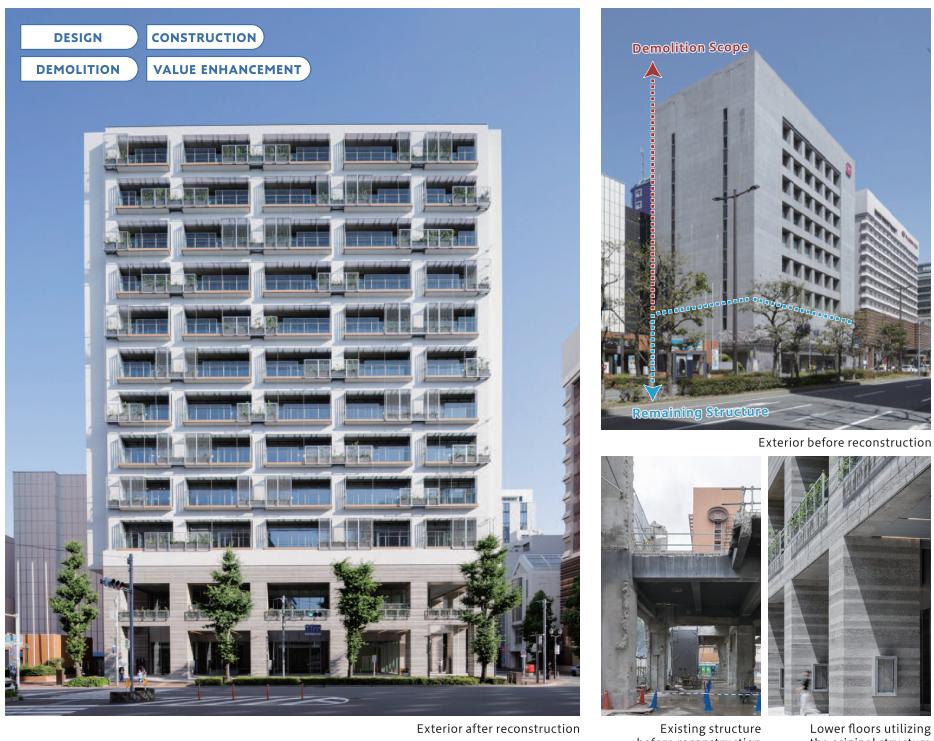


A washroom that preserves the traces of the old staircase



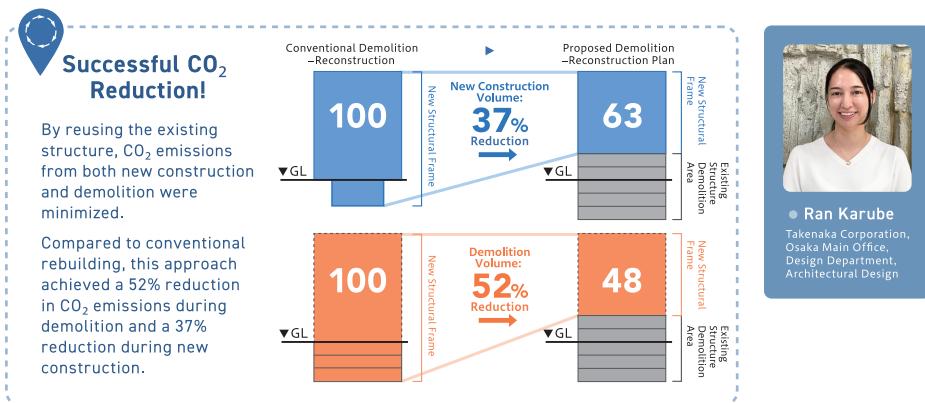
The situation upon completion of the reduction and demolition

## Pushing the Boundaries of Reconstruction – Discovering a New Answer Beyond Imagination



The Chuo Nittochi Hakata Ekimae Building is a redevelopment project that reuses the existing structure from the basement through the second floor, introducing a mid-level seismic isolation layer between the retained and newly constructed portions.

After demolishing the existing structure from the third to the tenth floor, the remaining basement and lower levels were reinforced, and a seismic isolation layer was installed at the intermediate level (the former third floor). A new superstructure was then built above it, achieving both enhanced seismic performance and a significant reduction in environmental impact through the reuse of the existing structure.



This project involves the preservation and adaptive reuse of the Hori Building, a Registered Tangible Cultural Property of Japan, located in Shimbashi, Minato-ku, Tokyo. Originally completed in 1932, the building was master-leased (partially leased) by Takenaka Corporation, renovated, and now operates as a shared office space.

Maintaining a historically valuable structure in the heart of Tokyo presented many challenges. Through the integration of design excellence and technical innovation, we enhanced its cultural appeal and revitalized it as a dynamic presence capable of engaging diverse audiences.

Today, the renewed Hori Building attracts a vibrant community of co-working professionals and serves as a platform for collaboration – hosting seminars, workshops, and various community events.



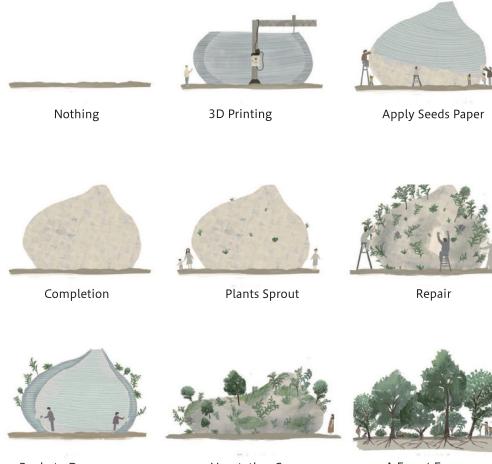


View of the pavilion at Expo 2025 Osaka, Kansai, Japan (Photo: Yosuke Ohtake)

This rest pavilion, created for the Expo 2025 Osaka, Kansai, Japan, was designed as a place for visitors to pause and relax. It was constructed using biodegradable resin through 3D printing, and has been recognized by the Guinness World Records™ as the world's largest single-piece 3D-printed architecture using biodegradable material.

Because it is a structure designed to exist for only 6 months during the Expo, every aspect—from the materials used to its post-use transformation—was carefully considered and designed as part of the architectural process.

Create



Use

Become a Forest

Designing the lifecycle of architecture through three stages: Make, Use, and Become a Forest

**Forest Architecture**  
Building Use: Rest Pavilion  
Total Floor Area: 31 m<sup>2</sup> Completion: 2025

**Off-Grid Field**  
Building Use: Retail, Office, and Accommodation Facilities  
Total Floor Area: Approximately 7.5 m<sup>2</sup>  
Completion: 2024

## Field and Community Development Independent from Existing Infrastructure



As a model case, an Off-Grid Experience Park is currently under development in Odawara City, scheduled for full opening in 2027.

This initiative proposes a new type of community independent from existing infrastructure, featuring off-grid trailer houses equipped with self-sustaining power generation and satellite communication systems. Each unit also integrates water supply, sewage (toilet), and waste treatment systems, forming a lineup of truly autonomous, self-contained facilities.

Looking ahead, these mobile trailer houses will serve not only as everyday living and working spaces, but also as disaster-resilient infrastructure, contributing to solutions for social and environmental challenges.



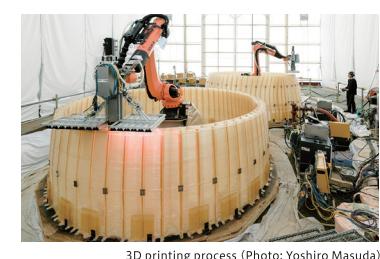
I aim to propose new forms of community development that do not rely on existing infrastructure.

● **Naritaka Hiroato**

Takenaka Corporation, Corporate Planning Department, Business Development Promotion



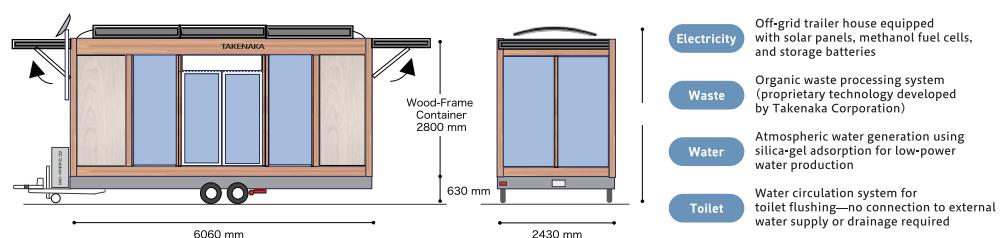
Exhibited as a mobile retail unit at Expo 2025 Osaka, Kansai, Japan



3D printing process (Photo: Yoshiro Masuda)

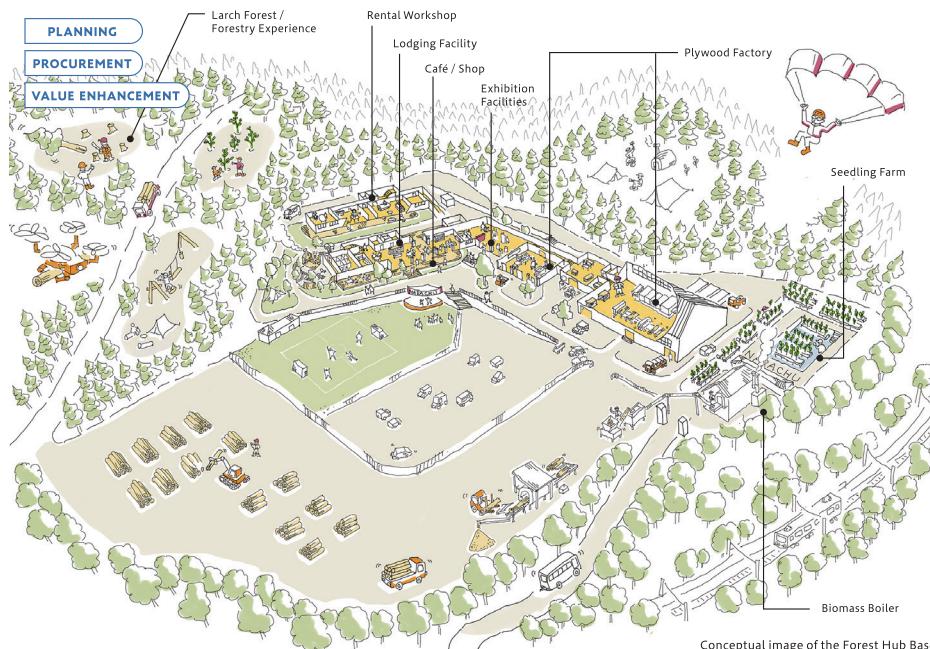


● Tooru Inaba  
Framework and Fireproof Engineering  
● Takaki Kurihara  
Structural and Construction Methodology  
● Yuki Idosako  
Structural and Construction Methodology



## NEXT CHALLENGE

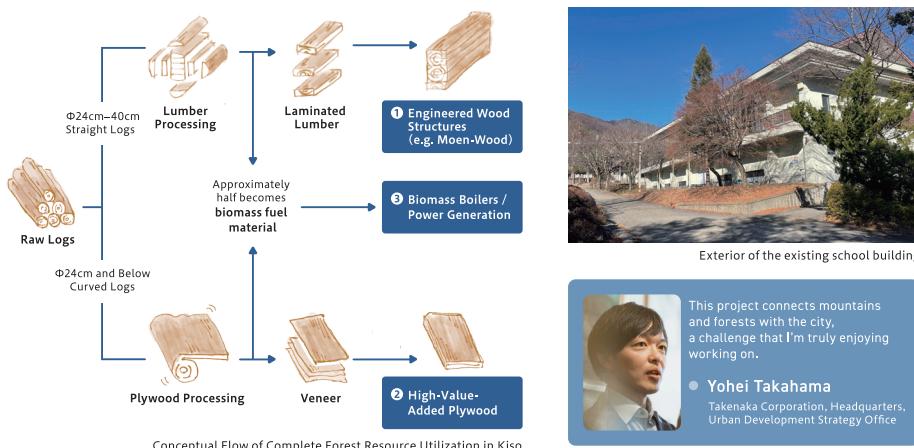
### Reviving an Abandoned Mountain School as a Hub for Forest Utilization



The Kiso Forest Grand Cycle Project is a new initiative that revitalizes the abundant forest resources of Kiso—a region rich in larch and cypress trees—through comprehensive utilization.

Large-diameter logs are processed into large-section structural lumber through lamination and adhesion, while smaller logs are transformed into high-value plywood using rotary peeling, adhesion, and molding techniques. Wood waste generated during production is thermally recycled as an energy source, ensuring that no part of the forest resources goes unused.

By repurposing closed schools in Shiojiri City and Kiso Town, Nagano Prefecture, the project transforms them into a plywood factory and "forest hub", creating a sustainable cycle that regenerates both forest resources and architectural stock in rural mountain communities.



**Kiso Forest Grand Cycle**  
Building Use: Factory, Accommodation, Café, Shop, and Exhibition Facility  
Total Floor Area: 4,847 m<sup>2</sup>  
Completion: Scheduled for 2026

## Circular Design-Build — Connected by Every Human Intention

Every work created through Circular Design-Build carries with it human thoughts, care, and creativity.

For the animals, insects, and plants that share this planet.

For the next generation who will live in the future.

For someone who will use this building next.

The more ideas, skills, and passions come together, the more Circular Design-Build will continue to expand and connect.

Why not join us as a Circular Friend to help shape the future through architecture?

From new construction projects to renovations, many Circular Friends have already begun this new journey together with Takenaka Corporation.

Now, it's your turn.

Go with!  
Circular Friends!

## Architecture That Evolves – and Is Always Loved

### Toward a Future Where Customization Becomes a Joy



#### TECHNOLOGY DEVELOPMENT DEMOLITION

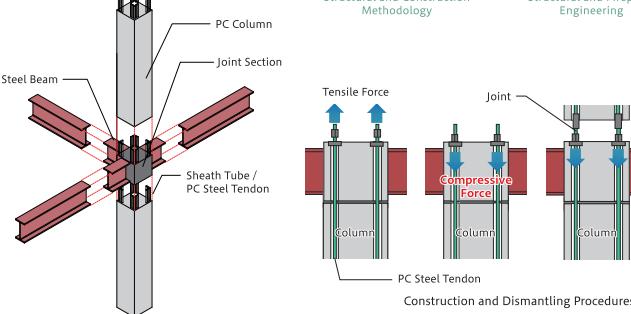
### A Structural Framework Designed to Be Assembled, Used, Disassembled, and Reused

#### Circular Structure Development Phase

We are developing technologies that enable the reuse of structural frameworks.

The columns employ an unbonded post-tensioned concrete (PC) structure using PC steel tendons, while the beams utilize a steel frame with bolted connections, allowing each structural member to be easily detached and reused.

Currently, we are conducting a series of experimental verifications to identify connection methods that ensure both ease of dismantling and maintenance of structural integrity and quality.



Although there are still challenges to overcome, we are working toward the early practical application of structural frame reuse.



Circular Friend  
**Satoshi Kake**  
Takenaka Corporation,  
Research & Development Institute,  
Structural and Construction  
Methodology



Circular Friend  
**Fumi Ushiwata**  
Takenaka Corporation,  
Research & Development Institute,  
Structural and Fireproof  
Engineering

● Permanent lightweight crane built into the substructure steel frame to facilitate partial renovations. ● Easily attachable and detachable exterior units—including green walls, solar panels, sun-shading louvers, and signage—allowing customization based on use or location. ● Detachable structural frame (“Circular Structure”) designed for assembly, disassembly, and reuse. ● Substructure steel reused from existing building equipment frames to support new exterior panels. ● Recycled concrete from existing buildings, crushed and reused as roadbed/base course material.

#### Maintenance & Operation

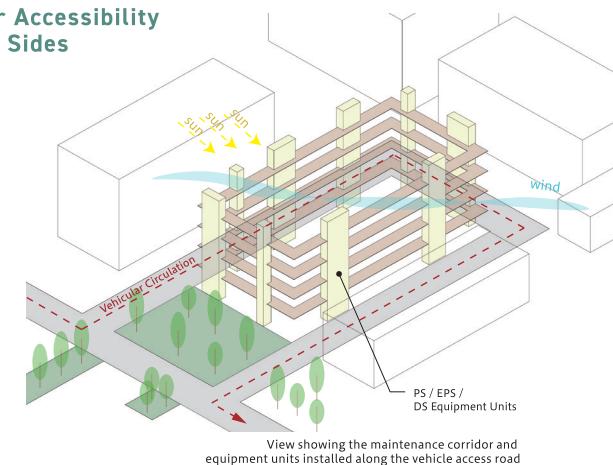
#### Design

### A Building Layout Designed for Accessibility and Adaptability from All Four Sides

This building plan is designed with future tenant reconfiguration and functional conversion in mind, aiming to achieve long-term building life and sustained value.

By securing open space on all four sides, the layout eliminates the concept of a “back side” and provides maintenance corridors along the perimeter that house PS, EPS, and DS systems. These semi-outdoor terraces encourage natural ventilation, reduce solar radiation to the interior, and consequently lower thermal loads during building operation.

The design separates the structural frame, intended for long-term use, from the exterior, equipment, and finishes, which can be flexibly adapted to meet changing times and user needs.



Circular Friend  
**Daiki Yokoyama**  
Takenaka Corporation, Tokyo Main Office,  
Design Department, Architectural Design

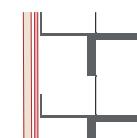
#### Design Demolition

#### Maintenance & Operation

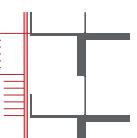
### A Reusable Facade Design with Detachable, Multi-Functional Units



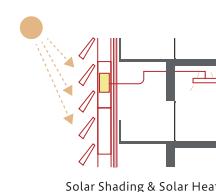
Exterior Image



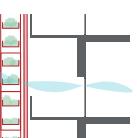
Wood-Finish Unit



Staircase Unit



Solar Shading & Solar Heat  
Collection Unit



Green Wall Unit

This facade concept features detachable, multi-functional units that can be replaced or rearranged for different purposes—including green walls, solar panels, wood panels that add warmth to the exterior, sun-shading louvers, and advertising displays.

The design envisions that these units can be interchanged according to the needs of building owners or tenants. A maintenance corridor runs along the facade, allowing easy access for inspection and replacement of panels from the exterior side.

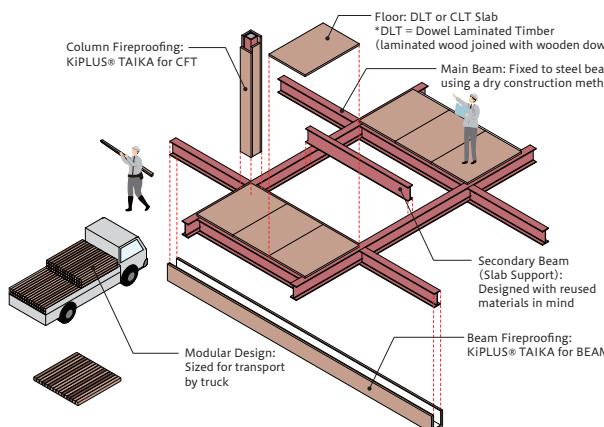
# From Factory to Office, to Housing, and Beyond – Designing a System That Allows Buildings to Evolve with the Times

TECHNOLOGY DEVELOPMENT DEMOLITION VALUE ENHANCEMENT

## A Flexible Structural Plan Designed for Reuse and Customization

### Development of an Adhesive-Free Timber Framework Development Phase

We are developing technologies that incorporate wood into components such as fireproof coverings that protect steel columns and beams from heat during a fire, and dry floor slabs that can be easily disassembled when changing the building's function or tenant layout in the future. The use of reclaimed wood is also being explored. Additionally, screw fastening is adopted to allow for easy removal and reuse of components, contributing to decarbonization and the circular use of resources.



**Circular Friend**  
**Tomohiro Iida**  
Takenaka Corporation,  
Timber & Wood Construction  
Promotion Department



**Circular Friend**  
**Takahiro Hebiishi**  
Takenaka Corporation,  
Technical Headquarters,  
Intellectual Property Department



This architectural plan focuses on ease of renovation and minimization of waste by carefully organizing floor height, separating the levels of beams and service pipes, and planning for future-ready cores, maintenance routes, and atrium spaces.

The design enables adaptability to diverse future uses, such as tenant reconfiguration and functional conversion.

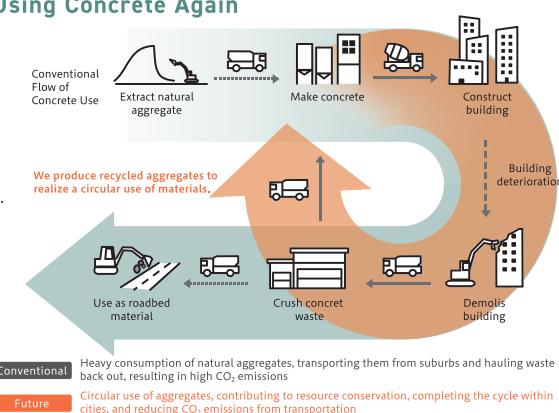
PLANNING TECHNOLOGY DEVELOPMENT CONSTRUCTION

## Casting, Using, Demolishing – and Using Concrete Again

### Circular Concrete Development Phase

We are developing a resource-circulating concrete that reuses aggregates such as sand and gravel, significantly reducing environmental impact. Since fiscal year 2024, we have launched a joint research project with ten partner companies in the Tokyo metropolitan area, supported by NEDO (New Energy and Industrial Technology Development Organization). This initiative aims to expand the application of Circular Concrete across major urban regions.

**Circular Friend**  
**Daisuke Honma**  
Takenaka Corporation, Headquarters,  
Research & Development Institute,  
Construction Materials

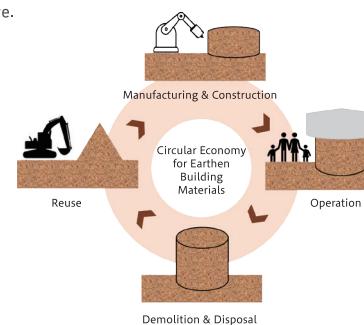


PLANNING TECHNOLOGY DEVELOPMENT CONSTRUCTION

## Turning Excavated Soil into a New Building Material

### Circular Economy Building Material Using Excavated Soil Research Phase

This eco-conscious building material is made by mixing excavated construction soil with biodegradable resin and hardening it. It can be produced and applied directly on-site, supporting a local production and local use approach. By adopting a drying process instead of firing, CO2 emissions are significantly reduced. Combining the natural warmth of earthen materials with environmental sustainability, this innovative material aims to contribute to decarbonization, resource circulation, and coexistence with nature.



**Circular Friend**  
**Naoko Nakajima**  
Takenaka Corporation, Headquarters,  
Research & Development Institute,  
Advanced Materials

# A Future City Where Buildings, Roads, Airplanes, and Furniture etc. Are All Connected Through Shared Resources

This circular city model envisions the year 2050, where materials and energy are shared across the entire urban system—including the reuse of existing structures and facades, energy circulation, mobility, and infrastructure.

Looking toward 2050, the goal is to achieve a 100% reduction in construction waste generated during demolition or renovation. Beyond the construction industry, the model envisions a resource-circulating society that connects multiple sectors and industries.



## PROCUREMENT TECHNOLOGY DEVELOPMENT DEMOLITION

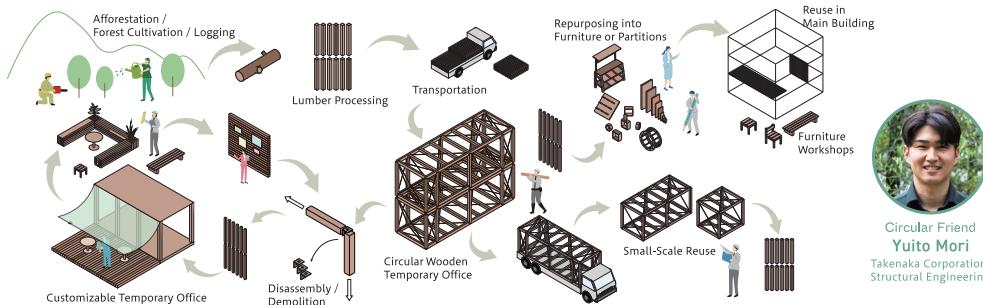
### Toward Reusable and Convertible Temporary Offices

#### Development of a Flexible and Circular Wooden Temporary Office Development Phase

We are developing a wooden temporary office that replaces the conventional prefabricated steel structure with a modular timber system, enabling each component to be reused for multiple purposes after use.

The wooden interior environment provides a sense of psychological comfort and offers a variety of workspace options, contributing to improved work engagement and employee well-being.

Furthermore, the timber components used in the temporary office are designed to be reused as partition walls or furniture in permanent buildings, extending the material's lifecycle beyond temporary use.

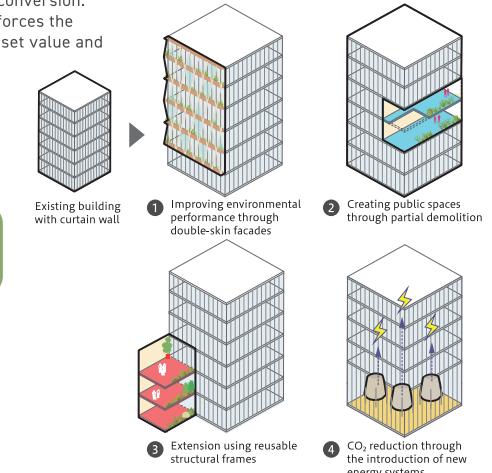
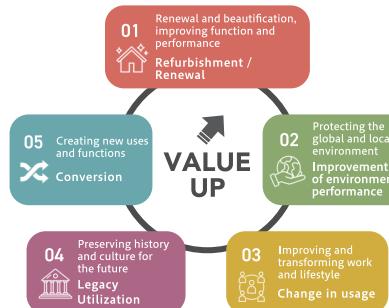


① Additional facade skins are applied to existing buildings as needed to improve envelope performance. ② Temporary wooden office structures, adaptable for various purposes such as modular shops or street furniture. ③ Removable floor systems created through partial floor reduction and the use of standard lumber processing systems, allowing flexible, temporary extensions based on user needs. ④ Excavated soil generated during construction is reused as rammed-earth walls. ⑤ On-site bioenergy systems which convert food waste into biogas, generating electricity and heat for sustainable building operations.

## DEMOLITION DESIGN VALUE ENHANCEMENT

### Creative Value Addition: Sustaining and Enhancing the Life of Architecture

For Takenaka Corporation, value enhancement goes beyond conventional maintenance or equipment renewal—it represents a creative transformation that significantly enhances a building's worth while enabling its continued use. Through detailed analysis of existing buildings—including location, age, floor configuration, and height—Takenaka proposes the optimal combination of strategies such as refurbishment and modernization, environmental upgrades, functional reconfiguration, heritage utilization, and conversion. By integrating these approaches, each element reinforces the others, resulting in a substantial increase in both asset value and profitability.



With Takenaka Corporation's technology and design expertise, we unlock the full potential of each building—enhancing asset value, improving profitability, and supporting our clients' contributions to the environment!



**Circular Friend**  
Takuji Hoshi  
Takenaka Corporation, FM Headquarters, Value-Up Promotion Team

## OPERATION TECHNOLOGY DEVELOPMENT

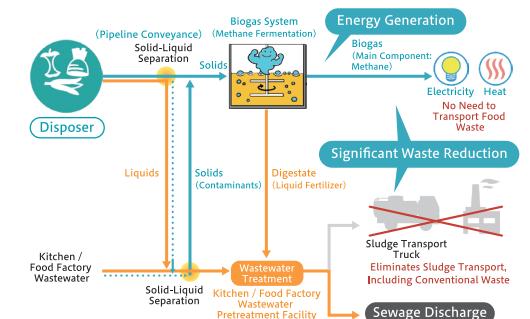
### Generating Energy from Food Waste



**Circular Friend**  
Masashi Funakawa  
Takenaka Corporation, Engineering Division, Environmental Symbiosis & Energy Division, Environmental Symbiosis

### Meta-Farm Development Phase

Meta-Farm is a building-integrated resource circulation system that generates biogas from food waste and organic matter contained in kitchen wastewater. By combining methane fermentation with wastewater treatment, the system significantly reduces sludge generation, transportation costs, and CO<sub>2</sub> emissions associated with food waste and sludge disposal. The surplus energy produced can also be utilized within the facility, achieving both CO<sub>2</sub> reduction and cost efficiency.



## Architectural Possibilities Beyond Imagination

The Future of Cities

### From a Closed Rooftop to an Open Oasis – Expanding



A partial reduction of the unused upper-floor tenant area is planned, creating space for new equipment installations and a lush rooftop terrace. The design promotes renewable energy use through newly installed solar panels and integrates various building systems to enhance overall energy circulation. A new hydronic unit using water as a refrigerant has also been introduced, anticipating future reuse and furthering the building's circular potential. The rooftop will function as a hub for energy flow across the entire structure.

① Reduce portions of the rooftop equipment base to create terrace and green spaces.

② Relocate the aluminum curtain wall (ACW) previously used on the exterior facade to the interior, reusing it as new window sashes.



### Carefully Dismantling and Reusing Materials from Existing Buildings to Create New Value

We create new value from what has already been built. For example, by reusing existing curtain walls – while preserving their wind resistance, water tightness, and aesthetic qualities – we adapt them to meet contemporary needs. This includes enhancing insulation performance, solar shading, and ease of maintenance, ensuring that materials continue to serve with renewed purpose in the next generation of architecture.

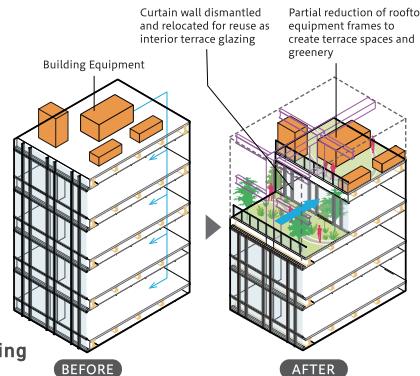


Removing glass panels from a demolition site.

#### Horizontal Glass Recycling

Development Phase

Glass is a material that can be recycled almost infinitely. To address climate change and realize a circular economy, we are promoting initiatives for horizontal recycling of window glass – returning used glass to its original quality for reuse in new architectural applications.



We are collaborating with partners across both the upstream and downstream industries to explore and advance initiatives for horizontal glass recycling.



**Circular Friend**  
**Naoya Kobayashi**  
AGC Inc., Architectural Glass, Asia Company, Sustainable Business Infrastructure Development Group, Manager, Architectural Glass Recycling Lead



Examining the dismantling procedure of aluminum sashes in an existing building.

#### Horizontal Aluminum Sash Recycling

Development Phase

We are promoting demonstration projects for horizontal recycling of aluminum components recovered from demolition, aiming to build a recycling system for aluminum building materials through collaboration between the construction (upstream) and recycling (downstream) industries.

We are conducting demonstration experiments to recover aluminum from building demolition sites.



**Circular Friend**  
**Maiko Iwasaki**  
Takenaka Corporation, Sales Division, Strategic Planning Department, Sales Strategy & DX



**Circular Friend**  
**Rina Matsunaga**  
Sankyo Tateyama, Inc., Sankyo Aluminum Company, Business Management Department, Business Planning Division, Business Development Section



### Upcycling Construction Waste

#### Upcycling Development Phase

We are developing a business that upcycles construction waste generated from demolition and new construction projects into new building materials, everyday goods, and products used within our company.

Through upcycling into daily-use items, we aim to enrich people's lives – extending the value created on construction sites into society at large.

We are exploring sales and leasing models for upcycled products as we move toward full-scale commercialization.



**Circular Friend**  
**Yuko Arai**  
Takenaka Corporation, Urban Development



Vases made from recycled concrete aggregate



Coasters made from recycled concrete aggregate



Fragrance sticks crafted from wood offcuts



Accessories crafted from wood offcuts

## To the Next Place, to the Next Person — A New Scheme Envisioning the “Second Life” of Building Materials

The transition from a recycling economy to a circular economy requires new systems that promote the reuse of building materials, enable easy access to circular materials, and support upcycling — the process of enhancing value through reuse. To achieve what was once considered impossible within the construction industry, we are taking deliberate steps to build these systems, one initiative at a time.

TECHNOLOGY DEVELOPMENT MAINTENANCE & OPERATION PLANNING PROCUREMENT

### B2B Building Materials Reuse Platform

Archi-Hub Development Phase

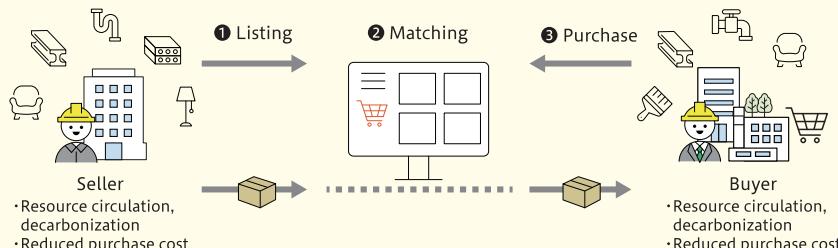
We have launched Archi-Hub, a BtoB platform for reusing building materials and furniture — connecting items no longer needed in one project to the next architectural development, rather than discarding them. The platform is currently in its development phase, with plans for future expansion to broaden its circular network across the industry.

We're seeing a steady increase in building owners who wish to both provide and make use of reused materials.



Circular Friend  
Kohhei Fujii  
Takenaka Corporation, Technical Division,  
New Business Technology Development

#### How Archi-Hub Works



We repurposed glass shades from chandeliers at a demolition site to create new wall-mounted light fixtures.



Circular Friend  
Yuki Takehiro  
Takenaka Corporation,  
Tokyo Main Office,  
Interior Design



We utilized 90% reused tile carpets throughout the entire building.



Circular Friend  
Tsutomu Takeda  
Takenaka Corporation,  
Hokkaido Branch,  
Production Control  
Division

TECHNOLOGY DEVELOPMENT MAINTENANCE & OPERATION PLANNING PROCUREMENT

### Developing an Open Search System for Circular and Low-Carbon Building Materials

Material Bank® Japan Development Phase

Using CTIs (Circular Transition Indicator), a potentially global standard for measuring circularity, we quantitatively visualize the circular performance of building materials. By listing these materials on the Material Bank® platform, we are creating a system that allows any registered user to freely access and explore circular and low-carbon materials.

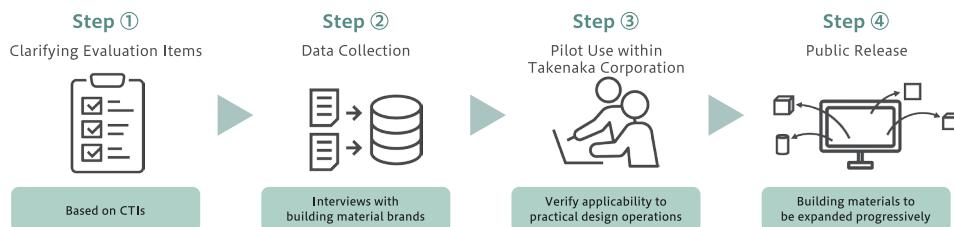
It's incredibly exciting and inspiring to promote circularity across organizations and with diverse stakeholders!



Circular Friend  
Genki Unno  
Takenaka Corporation,  
Tokyo Main Office, Design Division,  
Environmental Engineering



Circular Friend  
Takeshi Kajii  
DesignFuture Japan Inc.,  
CEO



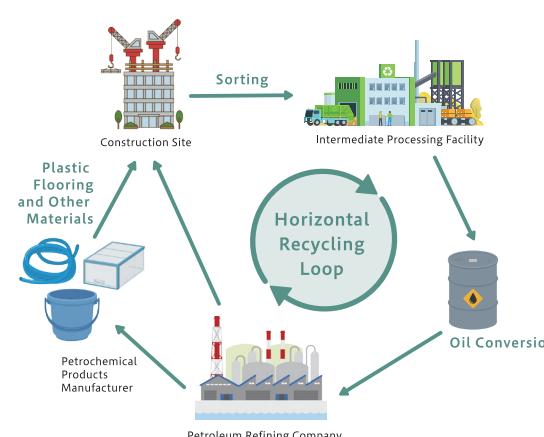
TECHNOLOGY DEVELOPMENT MAINTENANCE & OPERATION PROCUREMENT

### On-site Waste Separation and Upcycling System Using Plastic-to-Oil Technology

Waste Plastic-to-Oil Technology Development Phase

In collaboration with Chemical Recycling Japan Co., Ltd., Takenaka Corporation is working to recycle used plastics from construction sites.

By applying chemical recycling technology that converts waste plastics into oil, we are conducting demonstration experiments to regenerate resources — producing oil from plastics separated on-site and reusing it as raw material for products such as plastic flooring.



Circular Friend  
Hideto Takasaki  
Takenaka Corporation,  
Safety & Environmental Division



Circular Friend  
Yoshihiko Okamura  
Chemical Recycling Japan Co., Ltd.,  
President & CEO