

Climate Change Adaptation

**AIMING FOR SUSTAINABLE
URBAN DEVELOPMENT!**

***Turn construction waste
into functional pavement using
recycled bricks and roof tiles!***

持続可能な都市開発を目指して:レンガや屋根瓦のリサイクルによって機能性の高い舗装材をつくりだす

G I S

Goal ゴール

To make cities around the world more recycle-oriented.
世界中により循環型の都市をつくる

Issue 課題

In a developed city or a developing city in the future...

As urbanization progresses, and the ground is covered with concrete and asphalt, there are increasing risks of the 'heat island' phenomenon and heavy rains causing urban flooding.

先進国でも途上国でも都市化の進行によって地面がコンクリートやアスファルトに覆われヒートアイランドや洪水のリスクが高まっている



Solution 解決

We are working to provide solutions by offering the following:

私たちは以下のソリューションを提供します

- ① Permeable paving materials
- ② Water-retaining pavement materials
- ③ Know-how and technology to produce the above
- ④ Pavement material manufacturing equipment



**Mobile plant
(MOBACON)**

①透水性の高い舗装材②保水性の高い舗装材③製造するノウハウと技術④舗装材を製造する機材





Actually ...

**In Japan, people are
having trouble with
the processing of
Waste Roof Tiles.**

実は日本では屋根瓦の処理に苦慮している

Destruction of Waste Roof Tiles

屋根瓦の廃棄

About 1 to 2 million tons of waste roof tiles are generated every year in Japan.



Most of this ends up in Landfills.

ほとんどが埋め立て処分される

Convert waste roof tiles to construction materials!

屋根瓦を建設資材に!







WRT available in large quantities



Processing (crushing)



Grades and Uses for Crushed Recycled WRT			
Sand	Gravel and Chips		
	S	M	L
			

Gardening material



**Paving Material
(K-Ground)**



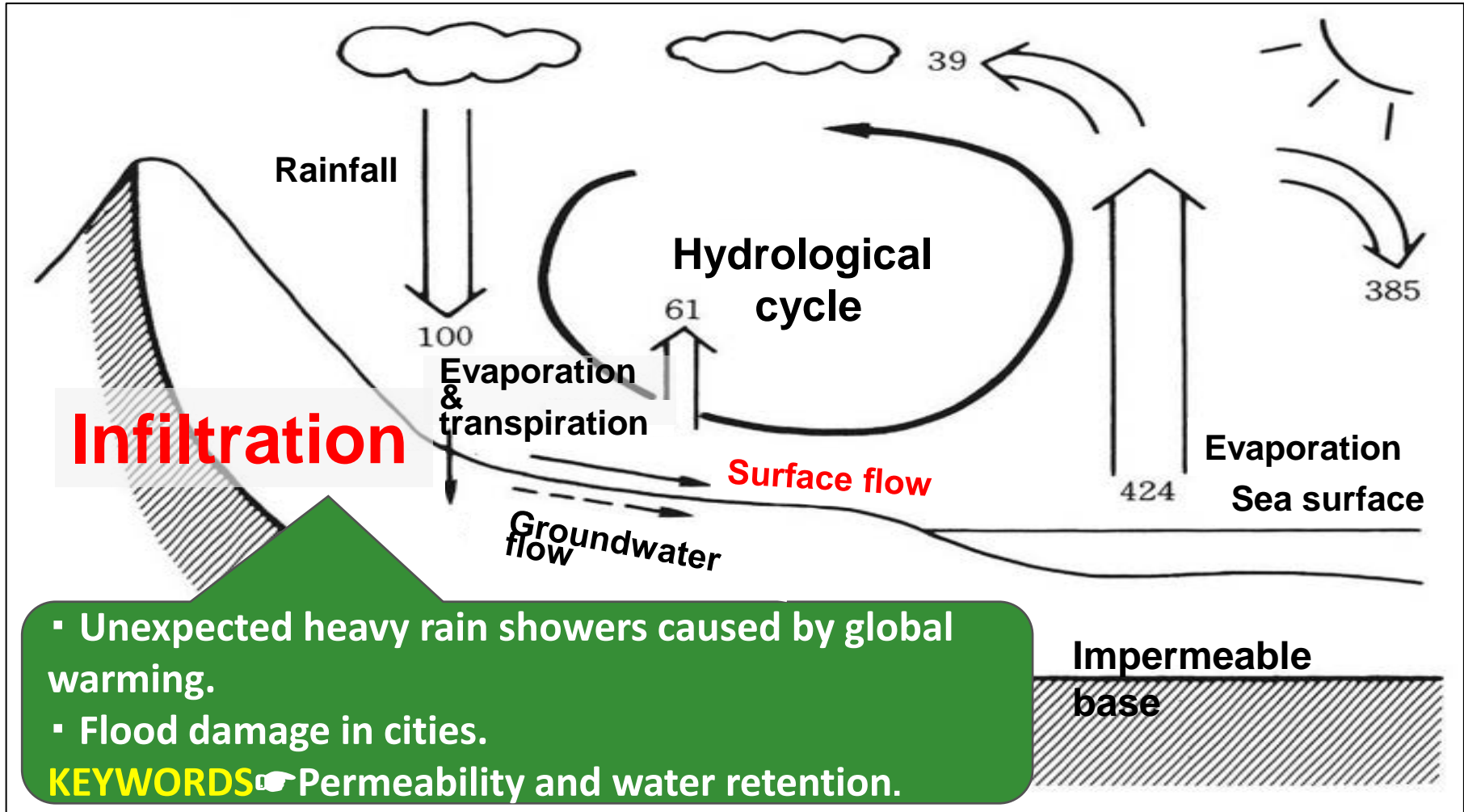
Features of roof tile pavement material

屋根瓦舗装材の特徴



The Water Cycle

水の循環



Recycled roof tile pavement

瓦舖裝材



Recycled roof tile pavement

瓦舗装材



Roof tile pavement is “COOL”

瓦舗装材は涼しい

Ishikawa Prefecture



Ready-mixed concrete plant



Recycled roof tile Paving Material
(Permeability & Water Retention)



**Cool
paving
material**



Improve the local environment with
recycled roof tile paving material!

Roof tiles and bricks = Ceramic products

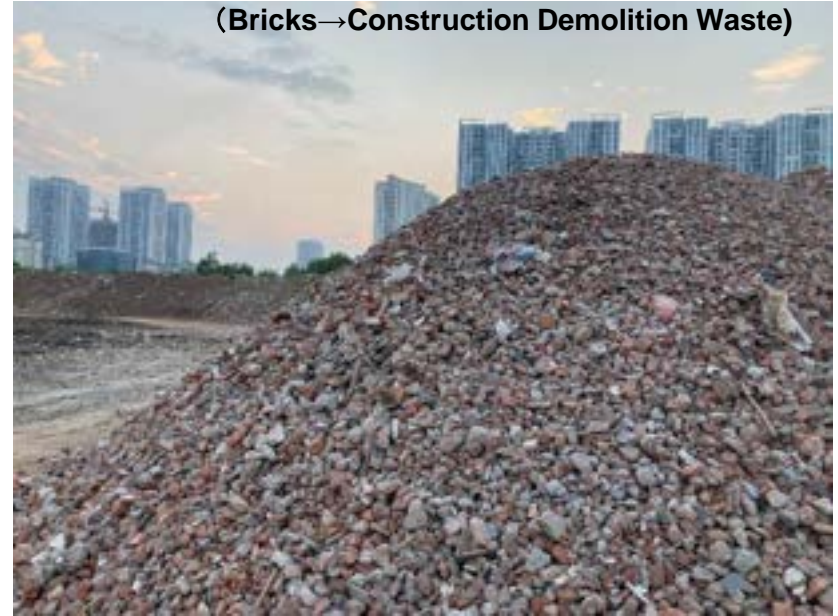
瓦とレンガ＝セラミック製品

JAPAN: Roof tiles > Bricks



Vietnam: Roof tiles < Bricks

(Bricks → Construction Demolition Waste)



Both roof tiles and bricks are made by firing clay at high temperatures.

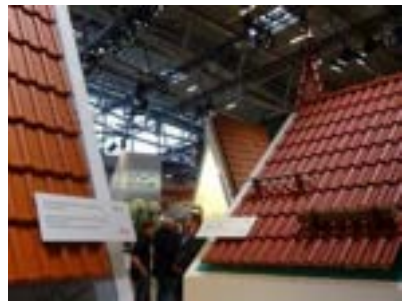
If it is fired, our know-how can be utilized.

Japan disposes of more roof tiles than bricks.

屋根瓦もレンガも焼いて作られます。焼いたものであれば私たちのノウハウを活用することが可能です。日本ではレンガより屋根瓦のほうが廃棄されています。

Ceramic products are found all over the world.

世界中にあるセラミック製品



Ceramic products are used all over the world.

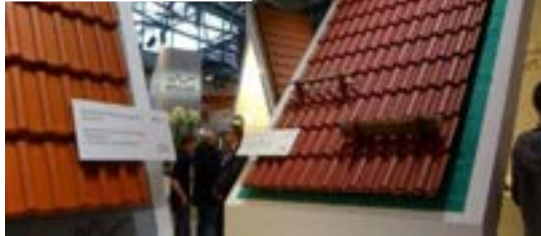
In particular,

Europe makes heavy use of both roof tiles and bricks, which are hard and can be recycled as pavement aggregates.

There are many roof tiles and bricks used in Asia and South America as well.

Ceramic products all over the world

世界中で使用されるセラミック製品



Roof tiles and brick.
(Germany)



Scenery of roof tiles
(Italy)



The building is mostly brick
(India)



House under construction
(Indonesia)



House under construction
(Vietnam)



Roof tiles and bricks
(Bolivia)

Make cities around the world recycle-oriented future cities

世界の都市を循環型未来都市に



Waste material from building demolition.



Brick & Roof Tile Factory
Manufacturing processes generate about 5 to 7% defective products, which then become waste.



A fixed plant has high installation & operating costs.



Crush and Particle size adjustment.



Local Partner Company

On-board ready-mixed concrete plant. [MOBICON]
It can also be used as a non-fired brick manufacturing machine.



Landfill disposal site, or illegal dumping?



A recycle-based future city where water circulates.

We can also manufacture and supply special ready-mixed products for infrastructure maintenance, responding to every demand.

Previous research in Vietnam

ベトナムで実施した調査

Proposals and feasibility studies for issues in Vietnam

Vietnam Country Characteristics and Global Warming Impacts

⇒ Vulnerable to climate change

- Long coastlines, low elevation cities, river deltas
- Increased flooding and inundation damage due to typhoons and heavy rain, rising sea levels
- Population, agriculture, and industry are concentrated in coastal areas, resulting in significant economic losses



Expansion
to
Vietnam

Large amount of construction waste generated

⇒ Urgent need for collection and recycling

- Large amount of construction waste from urban redevelopment: About 3,000 t/day in Hanoi
- Shortage of disposal sites, increase of illegal disposal:
negatively impacts sanitation, safety, and appearance
- Recycle 60% of construction waste by 2025

Proposed Technology

- K-Ground (water permeable and water retentive pavement material)
- K-Ground Coat (slip-resistant thin-layer pavement material)
- Water permeable and water-retentive interlocking blocks



Commercialization and dissemination of permeable and water-retentive pavements using recycled materials in Vietnam

- Introduction of Japanese technology and system:
Reuse of waste concrete, bricks, and tiles as pavement material: Recycled product certification system
- Underground recharge of rainwater by permeable and water-retaining pavements: Reduction of urban flooding ⇒ **Contribution in the field of application**
- Reuse of construction waste and recycled products:
Recycling of resources, reduction of burden on disposal sites, reduction of CO₂ emissions (**secondary effect**)

Feasibility Study (FS): 1) Study of standards for permeable and water-retentive pavements in Vietnam, 2) Study of a system to promote the use of recycled materials, 3) Study of commercialization, 4) Study of evaluation methods for introduction, 5) Study of utilization of CTCN technical assistance system

Previous research in Vietnam

ベトナムで実施した調査

Details of commercialization considerations and the future

Business Development Product Manufacturing and Sales Business

- Aggregate for permeable and water-retentive pavement
- Recycled crushed stone
- Permeable and water-retentive interlocking blocks



Effects of
Social
Implement
ation



Paving Business

- Expansion through franchise

Effects of Introduction

Recharge of rainwater through permeable and water-retentive pavement

- 730 mm/year-equivalent underground water retention, reduction of urban flooding. (Next page: Detailed image)

Reduction of construction waste (recycling)

- Reduction of 65 kg/m² (in the case of 10 cm surface layer)
- Reduction of load on final disposal sites, environmental improvement in the city

Reduction of GHG emissions

- Reduction of 12.6 kg-CO₂/ m² (for 10 cm surface layer)

Future proposals for commercialization and dissemination

- Promotion of commercialization and deployment to cities in Vietnam ⇒ **Demonstration project**
- Establishment of permeable and water-retentive pavement standards and interlocking block standards suitable for Vietnam ⇒ **Establishment of standards**
- Introduction of a construction waste recovery/reuse system and a recycled product certification system ⇒ **Capacity building support**
- Preparation of graphs, etc., to demonstrate the impact of introduction ⇒ **Study of evaluation method**
- Considering the use of CTCN etc.

Recharging effect of permeable pavement

透水性舗装の涵養効果

Recharging effect of introducing permeable pavement:

Approximately **730mm/year** (Calculation location: Da Nang)

Permeable pavement evaluation method

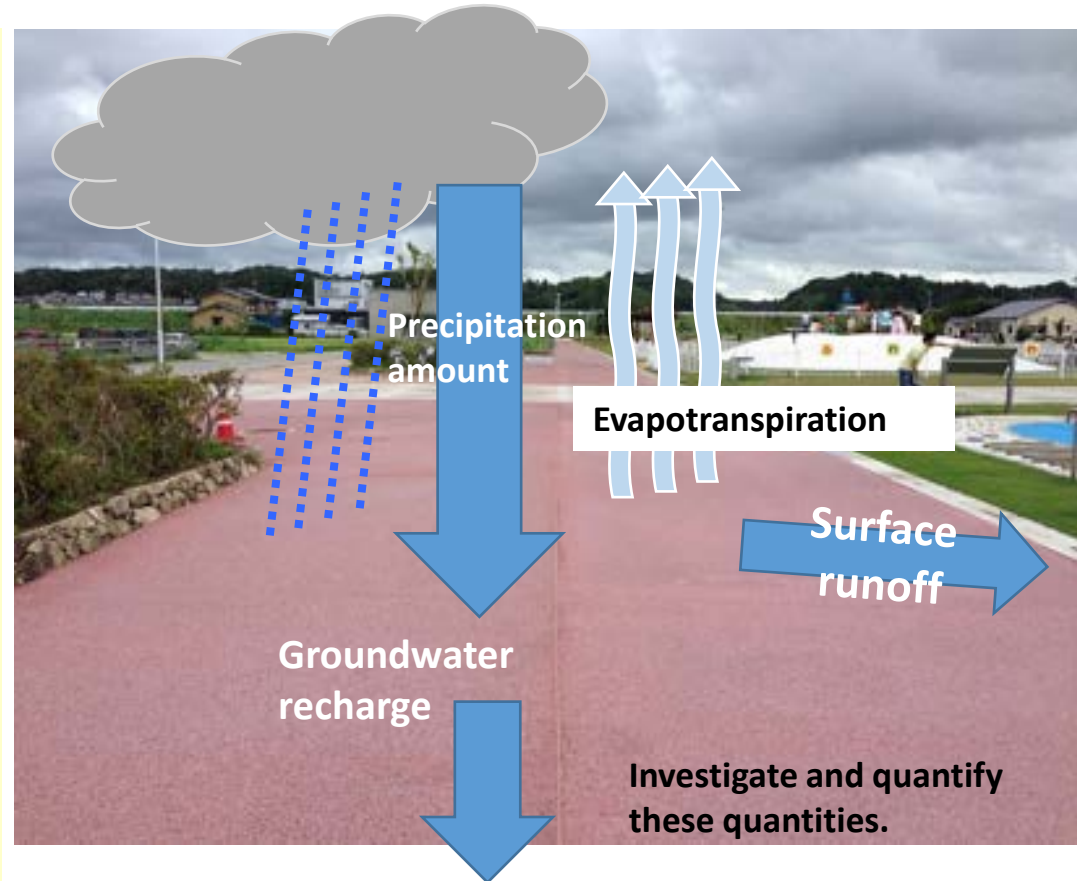
• Calculation of groundwater recharge effect (preventing rainwater runoff into sewage and rivers due to groundwater recharge) with and without permeable pavement

Calculation method of groundwater recharge effect

• Calculate evapotranspiration →
Calculate intermediate runoff →
Calculate surface runoff → Calculate groundwater recharge amount

Calculation results of groundwater recharge effect

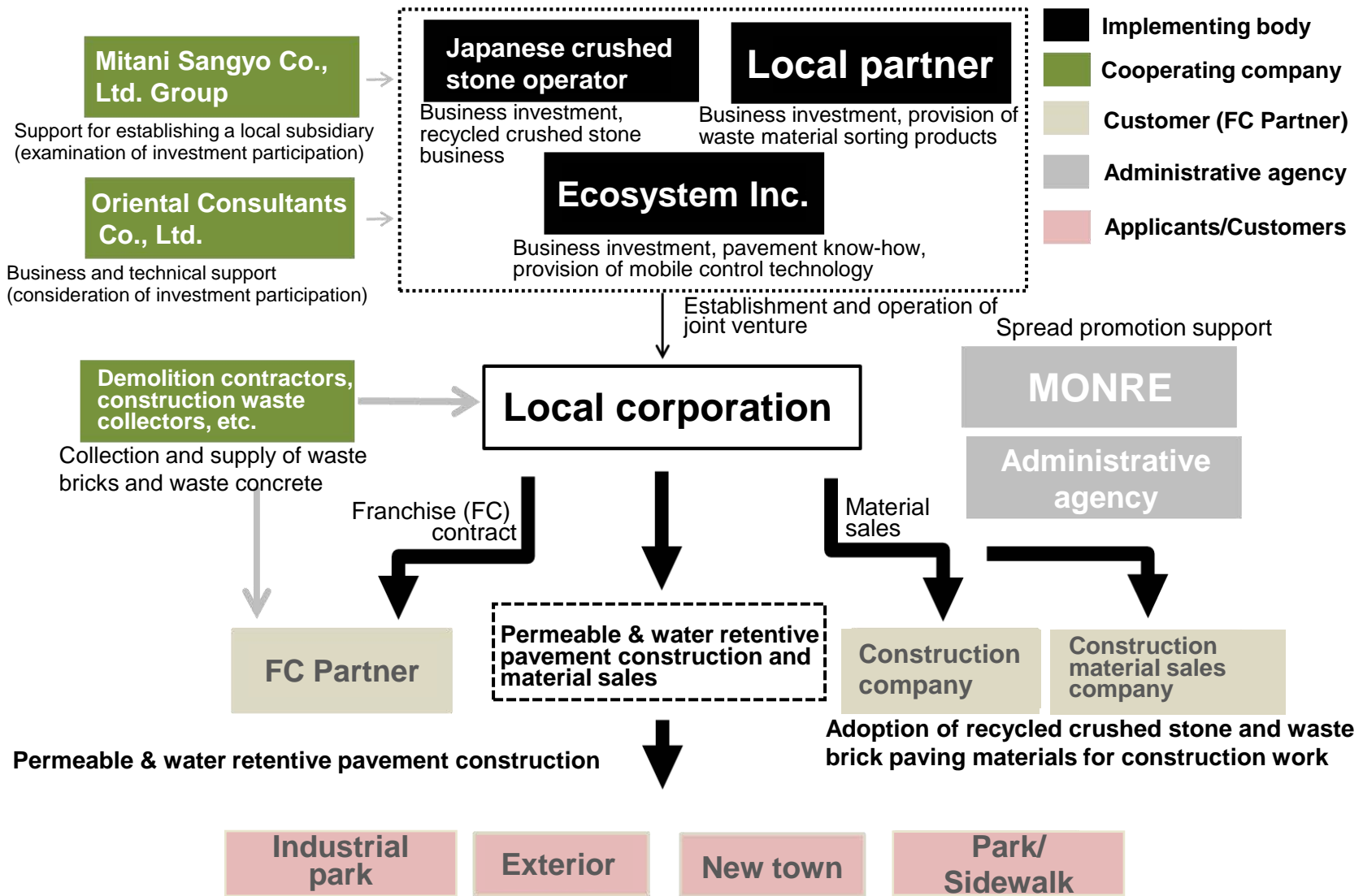
• Groundwater recharge effect by Introducing permeable pavement: 809
• Groundwater recharge effect due to non-introduction of permeable pavement: 77
→ **Difference: 732mm/year**



Annual rainfall in Da Nang: 3,000mm
⇒ **732mm/3,000mm** **Approximately**
25% of water is stored underground

Business model envisioned in Vietnam

ベトナムで検討したビジネスモデル



- Implementing body
- Cooperating company
- Customer (FC Partner)
- Administrative agency
- Applicants/Customers



Demonstration construction (Haiphong site)

ベトナム・ハイフォンでのデモ事業



With SATREPS
(HUCE & SAITAMA UNIV)

Demonstration construction (Haiphong site)

ベトナム・ハイフォンでのデモ事業



Field-installed products, not block-shaped products.

With SATREPS
(HUCE & SAITAMA UNIV)

Demonstration construction (Hanoi site)

ベトナム・ハノイでのデモ事業



With SATREPS
(HUCE & SAITAMA UNIV)

Demonstration construction (Hanoi site)

ベトナム・ハノイでのデモ事業



With SATREPS
(HUCE & SAITAMA UNIV)

Demonstration construction (Hanoi site)

ベトナム・ハノイでのデモ事業



With SATREPS
(HUCE & SAITAMA UNIV)

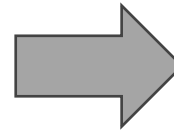
Monitoring of test construction sites

試験施工サイトでのモニタリング

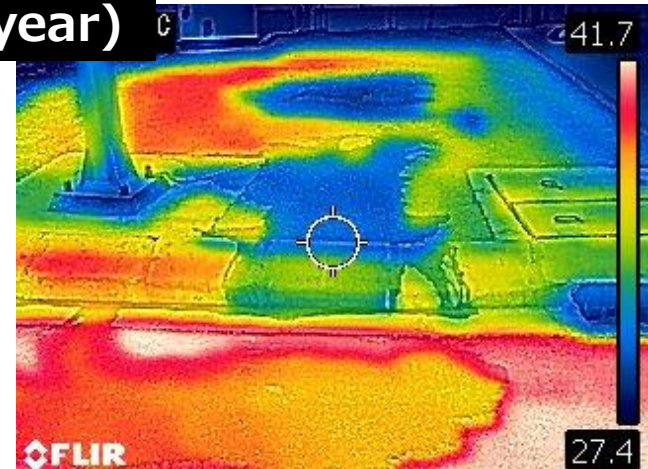
Monitoring items

1. Cracks, deformation, deterioration, etc.
2. Permeability in rainy weather
3. Clogging of pavement surface due to dust, etc.
4. Pavement surface temperature, etc.

DEEP C Industrial Park (after about half a year)

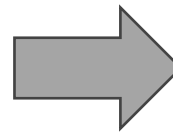


Road surface temperature change after watering



The temperature of the test construction location is low

HUCE (Hanoi University of Civil Engineering) (about 1 year progress)



Check surface toughness



There are tire marks, but the roughness is not bad.

Demonstration construction (Hanoi site)

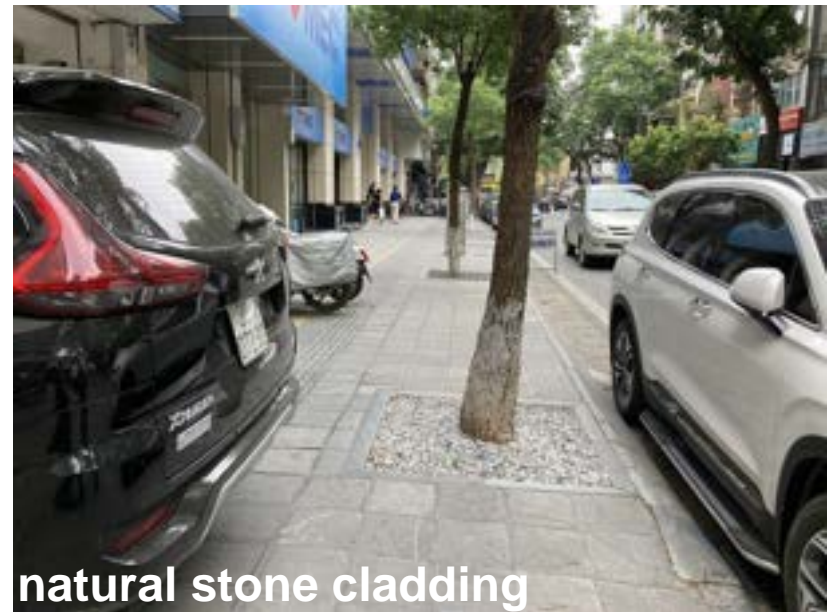
ベトナム・ハノイでのデモ事業

Video of water permeability (inside HUCE)



With SATREPS
(HUCE & SAITAMA UNIV)

Vietnam sidewalks, etc.



Expansion to Vietnam

ベトナムへの展開



Also considering secondary products such as interlocking blocks and flat blocks.

Mixing test

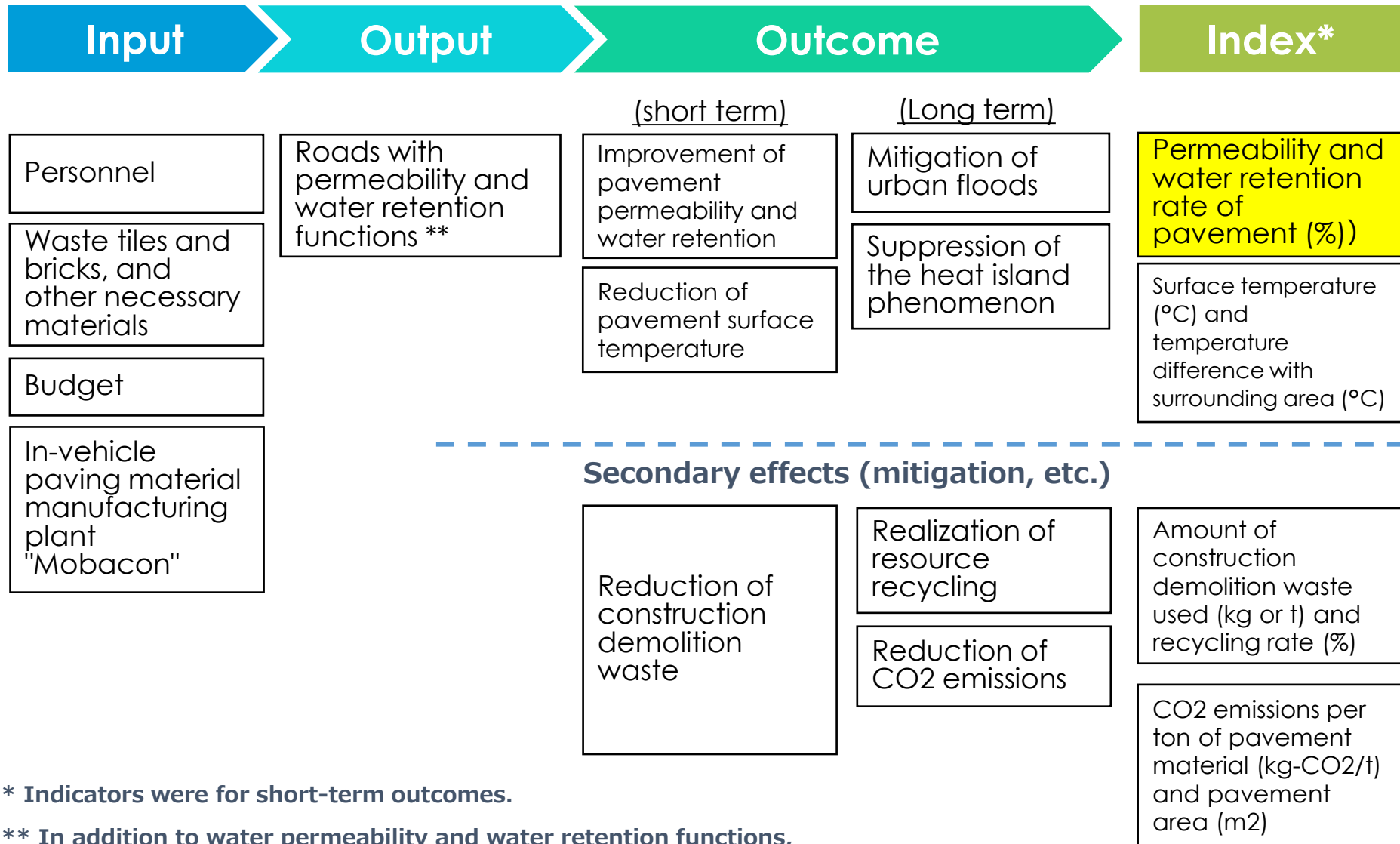
混練の実験

Suburbs of Ho Chi Minh City



**A compounding test will be conducted locally in August 2023.
Demonstration is underway toward making porous concrete into blocks.**

Trial of visualization



* Indicators were for short-term outcomes.

** In addition to water permeability and water retention functions, the product also features a high degree of scenic beauty.

METI "Good Practice Case Studies"

経産省 グッドプラクティス事例



METI

Ministry of Economy, Trade and Industry

Posted in Adaptation Business "Examples of Adaptation Good Practices by Japanese Companies"

Climate Change
Adaptation
Good Practices
by Japanese Private Sector
in Developing Countries

February 2022



5	1	Resilient Infrastructure against Natural Disasters	Development of anti-disaster information system for utilizing forestry preservation project	Kanematsu Corporation / Hitachi Ltd.	9 12 13
7	2	Resilient Infrastructure against Natural Disasters Climate Monitoring & Early Warning	Examining the Earth as "Earth Doctor"	Kawasaki Geological Engineering Co., Ltd.	9 13
9	3	Resilient Infrastructure against Natural Disasters Food Security & Strengthening Food Production Base Health & Nutrition	Water projects for realization of cooperative and rich society	Kubota Corporation	3 6 8 11 13
11	4	Resilient Infrastructure against Natural Disasters Climate Monitoring & Early Warning	Protecting society and infrastructure from slope disasters	Kokusai Kogyo Co., Ltd.	11 13
13	5	Resilient Infrastructure against Natural Disasters	Protecting local community from threat of high tide and sea level rise	TAISEI CORPORATION	9 11 13
14	6	Resilient Infrastructure against Natural Disasters	Methodology for prevention of soil surface erosion using image data distributed by river monitoring cameras	Nippon Koei Co., Ltd. Unimation System Inc. eTrust Co., Ltd.	6 11 13 15 11 13 11 13
21	9	Resilient Infrastructure against Natural Disasters	Functional paving materials made from waste roof tiles and bricks to reduce urban flooding and heat island effect	ECOSYSTEM Inc.	6 11 12 13
23	10	Resilient Infrastructure against Natural Disasters	Waterproofing and Extending the Service Life of Buildings with Concrete Repair Materials	ZEN Co., Ltd / Japan Prolong Limited Company	9 11 12 13
25	11	Sustainable Energy Supply	Introducing a resilient hybrid power generation control system against environmental changes	Kyudenko Corporation	7 13
27	12	Sustainable Energy Supply Climate Monitoring & Early Warning	Greater resilience in anti-disaster infrastructure through the world's first "Typhoon Power Generation" and communications satellite	Chalenergy Inc.	7 9 13
29	13	Sustainable Energy Supply	Mitigating damage to energy supply system in times of disasters	Panasonic Corporation	1 3 4 5 7 13
31	14	Food Security & Strengthening Food Production Base	Contributing to sustainable agriculture through "Bio-cycle"	Ajinomoto Co., Inc.	2 12 15

Introduced along with companies that represent Japan.

Our SDGs Mapping

SDGsマッピング



Company Profile & Mission Statement

会社概要とミッション



- Establishment
 - 1994/12/15
- Capital
 - 19.8 million yen
- 7 employees (21 groups in total)
- Company permission / license
 - Industrial waste disposal industry (waste roof tile)
 - Construction industry (civil engineering / paving work industry)



“ECO SYSTEM”

In addition to our company name,
it is at the heart of our philosophy.

Starting in 1994,

as a pioneer of WRT recycling,
this company has worked to protect the
global environment and to create a more
beautiful ecosystem for future generations.

I have taken the initiative,
through the recycling of WRT,
to improve the global ecosystem.

That is our mission.