Global Leader! Service Provider!

Sustainable Self-Supporting Road Construction and Management

“Renewal Project of Road Construction and Management System in Cambodia”

May 10th, 2022

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Korea Institute of Civil Engineering and Building Technology

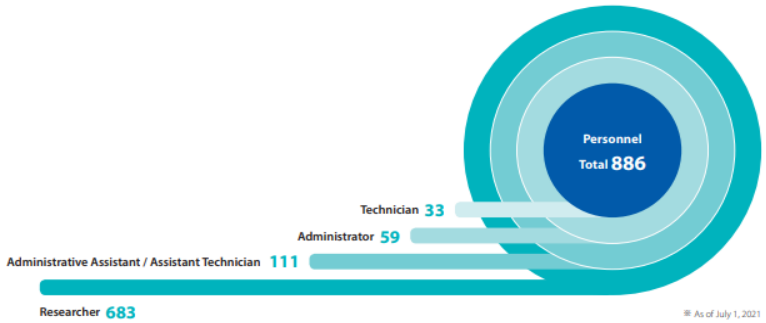
KICT Overview

Korea Institute of Civil Engineering and Building Technology (www.kict.re.kr)

- KICT was established and designated as a government-funded research institute under the Ministry of Construction in June, 1983.

Personnel

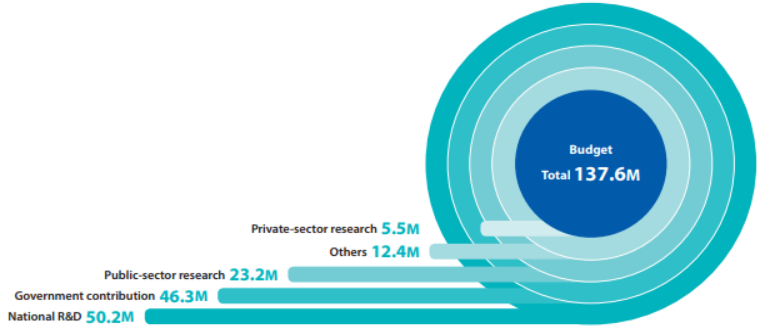
(Unit : Persons)



※ As of July 1, 2021

Budget

(Exchange rate : 1 USD = 1,196 / Unit : 1M = 1 million USD)



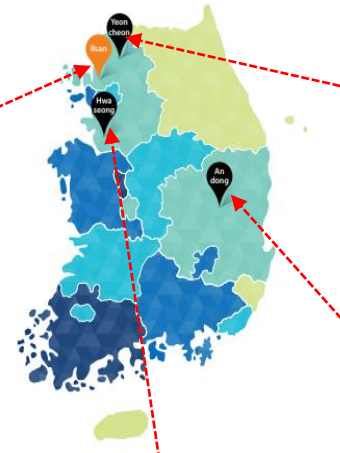
※ As of budget settlement in 2020

KICT Headquarter

30 labs

1 Main building			
2 Main building 2	3 Building Envelope Performance Test Laboratory / Pavement Material Test Laboratory	4 Structural Testing Laboratory	5 Construction Environment Research Laboratory
6 Indoor Air Quality Laboratory	7 Floor Impact Sound Test Building	8 Zero Carbon Green Home	9 KICT Welfare Center
10 Environmental Materials Research Laboratory	11 Wheel Load Testing Laboratory	12 Coastal & Harbor Laboratory	13 Construction Material Testing Laboratory
14 Acoustic Test Building	15-1 SOC Management Center 1	15-2 SOC Management Center 2	16 Geotechnical Engineering Laboratory
17 River Hydraulics Laboratory	18 Environmental Symbiotic Building	19 Full-Scale Geostructure Testing Laboratory	20 Water Resource & Environmental Research Building
21 High Performance Concrete Batch Plant	22 PIV (Particle Image Velocimetry) Hydraulic Laboratory	23 Advanced Road & Traffic Laboratory	24 Carbon Reducing Construction Materials Test-Bed
25 Construction Industry Innovation Center	26 Future Convergence Building	27 Water Current Meters Testing Site	28 Smart Construction Promotion Center 2
29 Outdoor Hydraulic Laboratory 1	30 Outdoor Hydraulic Laboratory 2		

Large-Scale Experiment Centers



SOC Evaluation Research Center

This center actively promotes a construction technology network hub that offers the public a "one-stop total R&BD verification service." It comprises SOC verification center, business support center, and construction and transportation R&D test bed.

Location Yeoncheon, Gyeonggi-do
Area 692,119 m²

Fire Research Center

The Fire Research Center includes a large-scale burn hall, a material property test lab, a combustion property test lab, and a high-performance fire resistance lab, all of which can conduct full-scale fire tests.

Location Hwaseong, Gyeonggi-do
Area 94,789 m²

River Experiment Center

The River Experiment Center enables various river experiments free from scale effects and has three experiment streams close to a prototype, monitoring facilities of river ecology systems, flow supply facilities to produce artificial floods of up to 10 m³/s, and retention reservoirs.

Location Andong, Gyeongsangbuk-do
Area 193,051 m²

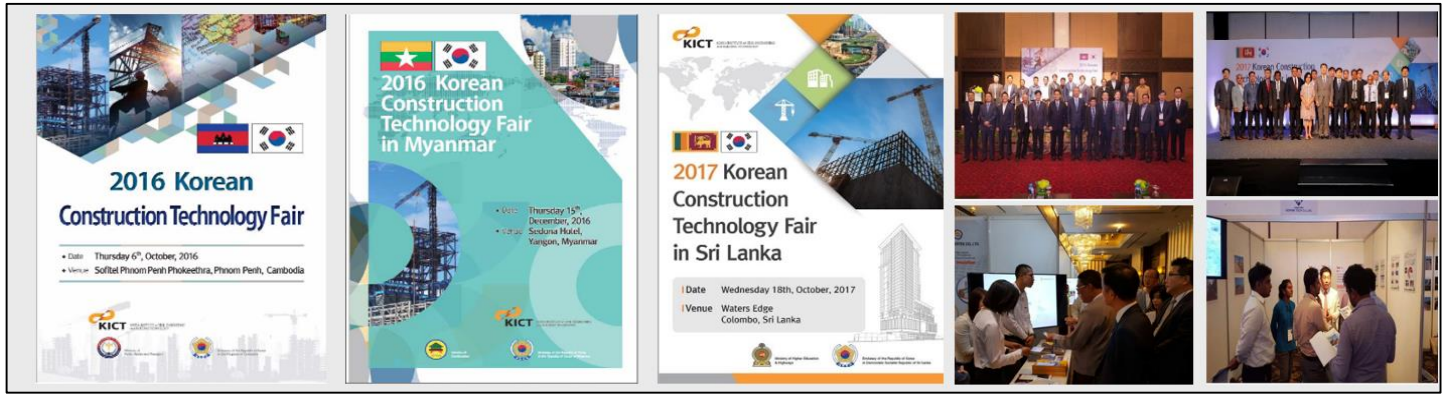
KICT Technology Overview

Partial Lists of “Made by KICT Appropriate Technology (TRL, Tech Readiness Level above 8 out of 10)”

Fields	Topic	#
Pavements	WMA (Warm-Mix Asphalt) Technology for Advanced Countries	1
	Glass Fiber Reinforced Asphalt Concrete	2
	Rubber Modified epoxy Asphalt Concrete	3
	Mechanistic Pavement Thickness Design (Engine and Design Suite)	4
	Asphalt and Concrete Composite Pavement System	5
Transportation and Automation	Road Survey Vehicle	6
	Tunnel & Bridge Management Systems Using a View Synthesis Technology	7
	Highway Management System	8
	Road Asset Management System	9
	Infra-free Line Lighting System	10
	Variable Traffic Message Sign (Energy saving and light weight)	11
	Pothole Detecting System (Advanced Real-time Image Processing)	12
Wastewater Treatment and Desalination	P/L-II Process (Biological nutrient removal process with side-stream): Treatment capacity > 5000 ton/d	13
	CF-SBR (Continuous Feeding and Intermittent Discharge Advanced BNR process) : for medium and small-scale plants (5000 ton/d and less)	14
	Hybrid Desalination Technology Using Membrane Distillation	15
	Advanced sewage treatment technology by continuous feeding and intermittent discharge	16
Advanced Building Technology	Multi-functional Super Window System with Solar Heat Gain Control	17
	Green Building: G-SEED (Green Standard for Energy and Environmental Design)	18
	Advanced sewage treatment technology by continuous feeding and intermittent discharge	19
Geotechnical Engineering	Non-welding composite pile	20
Structural Engineering	SUPER Concrete Technology (Ultra High Performance)	21
Information Technology	BIM-GIS Platform for SMART City	22
	Automatic Road Sign Recognition Technology	23
	Compact Platform for Big Data Analysis	24
Fire Research	Aluminum Composite Panel Using Incombustible Plastic for External finishing material	25
	Modular Mobile House for Fire safety	26
	Fire door using aluminum composite panel	27

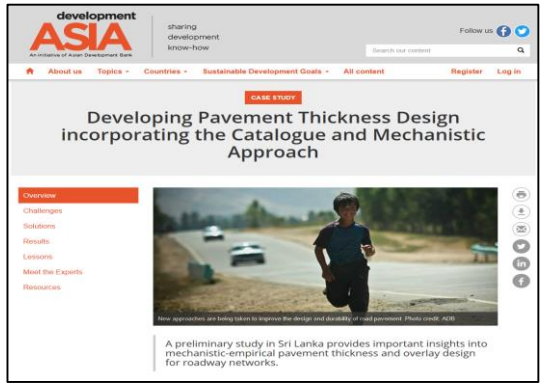
Introduce the construction technologies of KICT to government employees, researchers, and expert in member countries

- 2016 Korean Construction Technology Fair in Cambodia
- 2017 Korean Construction Technology Fair in Myanmar
- 2017 Korean Construction Technology Fair in in Sri Lanka
- 2018 Korean Construction Technology Fair in in Uzbekistan
- 2020 On-Line Korean Construction Tech. Fair in Indonesia



Knowledge Sharing

development ASIA
An initiative of Asian Development Bank
sharing development know-how



KICT International Projects

One of KICT's Role & Responsibility: Solve Global Problems through Cooperative Global Infra Projects

- With the driving force of the Korean Government on the basis of 3P Policy (People, Peace, and Prosperity)
- Customized construction technologies to meet the demand for national lands and transportation in developing countries

Project	Topic	Source
TA Project	TA-8271 SRI: Southern Highways Investment Program-002 Material Engineer/Pavement Design Specialist (46374-00)	ADB/RDA
	Materials, Equipment and Technology for Low-Mid Income Countries (MET)	WB
	Ethiopian Road Asset Management System (PMS, BMS)**	WB/ERA
	Consultancy Services for a Conceptual Design for Developing New Mondulkiri Airport	ADB
	Mechanistic Pavement Thickness Design (Engine and Design Suite)**	ADB/RDA
On-Going ODA Project	Road Construction and Management System	Cambodia
	Construction Building Code Modernnization	Uzbekistan
	SMART City Cooperation Center	Vietnam
	Roadway Pavement Renewal Project	Laos
	WARM-MIX Pavement Technology	Vietnam
	Roadway Research Tech and Lab Construction	Paraguay
**On-going TA Projects, RDA(Road Development Authority, Sri Lanka), ERA(Ethiopian Road Authority)		
KICT Internal Funding for Member Countries (37 Projects from 2015)	Localization of foundation and soil reinforcement technology	Philippines
	Cold in-place pavement manufacturing and construction technology	Indonesia
	Automatic Pile Welding Machine Technology	Vietnam
	Geotechnical instrumentation and structural integrity monitoring system	Vietnam
	Construction method for the pressurized pile in soft ground	Indonesia
	Hybrid Asphalt Pavement Method in Developing Countries	Cambodia
	Asphalt stiffener attached with tack coating protective film	Mongolia
	Technical support for small enterprises to export ITS	Philippines
	LED road lighting technology for accident prevention at nighttime	Paraguay
	Korean Intelligent Transportation System (ITS) Export to Latin America	Peru
	Bus Information System in Thimphu, Bhutan	Bhuthan
	BH Girders for Southeast Asia	Malaysia
	Development of Urban Transportation	Peru

Project Title: "Renewal Project of Road Construction and Management System in Cambodia"

Recipient Country: Cambodia (Phnom Penh)

Project Period: July 1, 2020 - Oct 31, 2023 (36 months)

Project Budget: 3.5 Million USD

Purpose: I. Modernize PAVEMENT construction and management system in Cambodia
II. Pavement Research and Test Laboratory Construction
III. Donation of Lab Equipment and Survey Vehicle
IX. Trial S/W (Pavement Management System and Quality Management System)
V. Capacity Building

Authority in Charge: Korea - Ministry of Land, Infrastructure and Transport (MOLIT)
Cambodia - Ministry of Public Works and Transport (MPWT)

Stakeholder's Mutual Agreement in RoD

Korea (MOLIT): Funding and Technical Service Provider

Cambodia (MPWT): Necessary approvals (TAX free, laws and regulation, land grant, and basic infra (electricity, sewage etc..) and Lab Construction

ODA Issue Statements

Road Infrastructure/Roadway Construction Environment and QC/QA Problems in Cambodia

Seriously damaged road infrastructure

① Lack of experience in road design
② Poor road construction management and supervision system
③ Poor road construction evaluation system
④ Lack of certification and verification system

It is necessary to modernize the road design, construction management, supervision, evaluation, certification, and verification systems.

Absence of professional agency and personnel

① Absence of exclusive agency in charge
② Deteriorated equipment for certification and verification
③ Absence of professional management and supervision personnel
④ No development of professional manpower

An exclusive agency in charge of road design, construction, and maintenance is necessary.
*
It is necessary to secure Equipment for experiments and develop professional manpower.

Road Construction/Management Experiences of Korean Partners

Road infrastructure damage occurs repeatedly due to the lack of road construction management, supervision, and maintenance capability in Cambodia (Needs: Pavement Quality Management System)

→ MPWT also emphasizes the need for a road infrastructure management system in Cambodia

Project

Korea-Cambodia Friendship Road Construction Project (2012)

Problems

- KOICA supported 9.2 million USD 'Bypass construction project for the Angkor Wat in Siem Reap' (completed in 2012)
- After the completion of mentioned project, road damage occurred and has accelerated the damage due to careless maintenance Cambodian government lacked the internal maintenance system

Project

No. 2/21/22/48
National Road Construction Project in Cambodia (2017~)

Problems

- EDCF's credit support 'No. 21 National Road Renovation Project' (completed in 2017)
- Road damage occurred (cracks, port hole, bleeding)
- Cambodian government is unable to verify the quality and lacks the capability to identify the reasons for damage and solve the damage

Mutual Understanding of Initial Strategy Set-up

Objective: Provide **independently sustainable road infrastructure construction management role** in Cambodia

Strategy: Establishment of mutual cooperation system for establishing sound road infrastructure in Cambodia

Strategy 1: S/W	Strategy 2: H/W	Strategy 3: Capacity	Strategy 4: Policy
Establish road construction management system and evaluation, certification, verification systems	Provide equipment and support the test operation of research institute of construction technologies in Cambodia	Reinforce the capability of professionals and establish young talent training program	Utilize an overseas strategic position for national land infrastructure development projects in Korea
Safe and sound road construction Improvement of road construction management system and construction standard Establishment of evaluation, certification, and verification systems	**Modernization of road construction management and supervision** Provide experiment materials and field investigation equipment (Modernize road construction management and maintenance system)	**Sustainable independence of self-supporting research institute** Prepare the basis for independence through test operation of research institute of construction technologies in Cambodia	**Utilization and development of excellent manpower** Reinforce the capability of professional manpower and develop young talent	**Utilization of a strategic position to find a national land infrastructure development project** Utilize it as the strategic position to lead new south policy (linked with PPP Projects)

Main Contents of the Current ODA Project

R&R of donor country (Korean government)

TASK 1. Modernization of road construction management system and construction standard

- Prepare efficient road construction/quality management system (evaluation, certification, verification)
- Modernize road construction supervision and maintenance system
- Promote standardization by improving and revising the deteriorated road construction-related standards

TASK 2. Build a sustainable self-supporting research institute

- Building a research institute of construction technologies in MPWT
- Improve existing laboratories and field investigation equipment storage facilities

TASK 3. Provision of experiment equipment and field investigation equipment (Transfer of operation know-how)

- Provide testing materials and equipment (management, certification, evaluation) and field investigation equipment (evaluation, verification)

TASK 4. Independence of research institute of construction technologies in Cambodia through test operation

- Test operation of functions of research institute (management, evaluation, certification, verification, etc.)
- Verification of improved road construction standards, specifications and guidelines
- Verification of improved road construction management system
- Verification of role of research institute and improvement of problems

TASK 5. Reinforcement of capability of local professionals and development of young talent

- Reinforce the professional capability of invited government officials and expand independent supply of manpower through local development of young talent in Cambodia

R&R of the recipient country (Cambodia)

1. Provide office space for the research institute of construction technologies in Cambodia
2. Provide professional manpower, administrative manpower and convenience necessary for operating the office for the research institute of construction technologies in Cambodia (practice of providing experiment equipment, materials, investigation equipment with tax exemption, etc.)
3. Support the reflection of road construction and maintenance system policies in Cambodia
4. Support the revision and reflection of local road construction standards to policies in Cambodia

Project output

1. Road construction and maintenance system in Cambodia (PMS and PQMS)
2. Evaluation and certification system for road construction materials
3. Advanced road construction standards in Cambodia
4. Sustainable self-supporting research institute of construction technologies in Cambodia
5. Material Testing equipment and field investigation equipment provided to research institute of construction technologies in Cambodia

Project outcome

- Short-term: Modernization of road infrastructure construction and management
- Mid-term: Operation of sustainable self-supporting research institute of construction technologies
- Long-term: Continuous establishment of sound road infrastructure in Cambodia

Main contents of project: Construction/Quality Management System

Cooperative Leading Project of Construction Technology in Cambodia

Modernize road construction/quality management system and construction standards

- Build a Construction Material Testing Lab
- Provide experiment materials and equipment & field investigation equipment
- Sustainable Lab O&M
- Capacity Building

Execution strategies

1. Prepare efficient road construction management system (management, evaluation, certification, verification)
2. Modernize road construction supervision system and revise the construction standards

Prepare the management system (evaluation, certification and verification) for efficient management of road construction in Cambodia

01 Quality standard for construction materials

- Present the quality standard (plan) for construction materials linked with road pavement problems in Cambodia
- Formulate the analysis and improvement (plan)of quality management system for construction materials in Cambodia

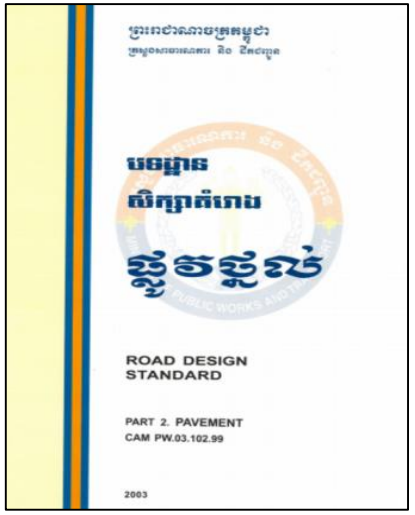
02 QC/QA pavement production and construction

- Present the quality standard (plan) for road pavement facility, production, and construction in Cambodia
- Formulate the management system (plan) for road pavement production and construction in Cambodia

03 Pavement Maintenance System

- Present the system (plan) to decide the road pavement condition investigation standard, maintenance period and method in Cambodia / C-PMS (plan)

Establish full cycle management system including road pavement production, construction, and maintenance.



Modernization of road construction supervision system

01 Improvement of road construction supervision system

- Investigate and analyze the road construction supervision system in Cambodia
- Improve and test operate the road construction supervision system

Improvement and revision of road designing and construction standards in Cambodia

01 Revision of road designing and construction standard

- Investigate and analyze specifications and guidelines in road construction field
- Improve and revise inappropriate road construction-related standards

Overview of PQMS and PMS Pilot models

Pavement Quality Management System(PQMS)

- Establishment of laboratory and field test standards for road pavement quality management
- Design of road pavement quality management, quality evaluation and verification system
- Quality management database for computerized system configuration
- Development of a prototype program pilot model
- PQMS pilot operation plan (establishment of roles for each client, constructor and supervisor)

The Development of PQMS and PMS in Cambodia : Pilot Model

Pavement Management System(PMS)

- Analysis of components of road pavement maintenance system in Cambodia
- Development of maintenance performance prediction model
- Design of PMS composition in Cambodia
- Development of decision-making logic considering Cambodia conditions
- Development of long-term economic analysis tools
- Development of a prototype program pilot model
- Propose PMS procedure guidelines
- Recommendaton of PMS business model in the future

During Construction

After Construction

Establishment of an appropriate trial-system for Pavement Management in Cambodia

Equipment and Technical Support → Modernize Management Systems → Empowering Professionals → Securing overseas platform for infra-structure business

Main contents of the project: Cambodian Institute of Construction Technology

Cooperative Leading Project of Construction Technology in Cambodia

- Modernize road construction management system and construction standard
- **Build a Construction Material Testing Lab**
- Provide experiment materials and equipment & field investigation equipment
- Sustainable O&M Lab
- Capacity Building

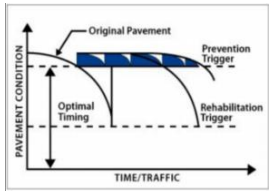
Execution strategies

1. Support the improvement of research institute of construction technologies in Cambodia within the MPWT (organization and contents)
2. Improve existing laboratories and field investigation equipment storage facilities

Support of sustainable self-supporting research institute of construction technologies in Cambodia by phase (Phase 1: Road field, Phase 2: Transportation field, Phase 3: Structure field)

Phase 1: Road field

•Road pavement designing, construction, and maintenance & management



Phase 2: Transportation field

•Transportation operation, ITS, safety, and logistics management system

Phase 3: Structure field

•Bridge, structural designing, and safety diagnosis, etc.

Main contents of the project: Auto Survey Vehicle and Lab Equipment

Cooperative Leading Project of Construction Technology in Cambodia

- Modernize road construction management system and construction standard
- Build a Construction Material Testing Lab
- **Provide experiment materials and equipment & field investigation equipment**
- Sustainable O&M Lab
- Capacity Building

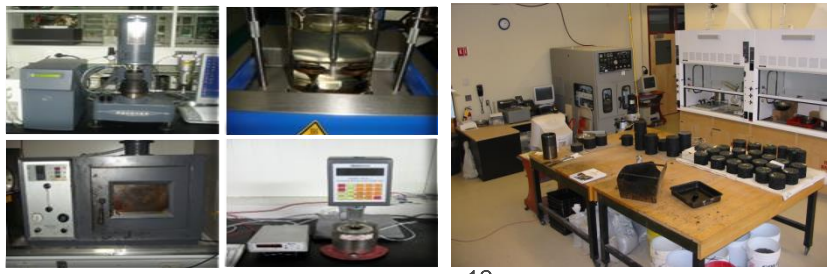
Execution strategies

1. Provide testing materials and equipment and support the operation education
2. Provide Korean-style field investigation equipment and support operation education

Establish the national laboratory and maintenance center for operating the road construction infrastructure evaluation, certification and verification system in Cambodia

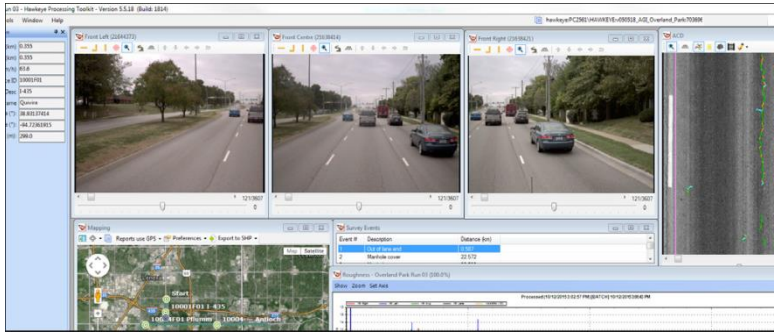
Provision of testing material and equipment and operation education

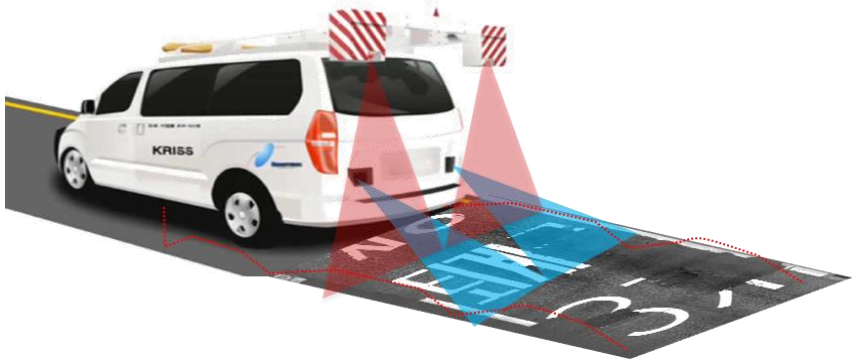
- **Provide testing equipment for road construction material** (management, certification, evaluation, verification)
  - Review the provision of deteriorated material and equipment
  - **Asphalt material (60), Aggregate(20), Concrete(20), Soil (15) Misc(30)**
- Support testing equipment operation education



Provision of road condition investigation equipment and operation education

- **Provide automatic road pavement condition investigation equipment (evaluation, verification)**
- Support automatic road pavement condition investigation equipment operation education





Main contents of the project: CICT QC/QA Certification Provider

Cooperative Leading Project of Construction Technology in Cambodia

- Modernize road construction management system and construction standard
- Build a Construction Material Testing Lab
- Provide experiment materials and equipment & field investigation equipment
- **Sustainable Lab O&M**
- Capacity Building

Execution strategies

1. Test operation of functions (management, evaluation, certification, verification, etc.) of research institute of construction technologies in Cambodia
2. Sustainable independence of research institute of construction technologies in Cambodia

Present the independence model of research institute of construction technologies in Cambodia through the pilot project (Lab O&M Strategy)

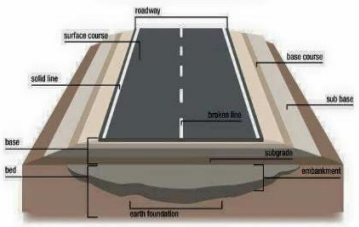
AS-IS

- Laboratory equipment was provided by France, ADB, and Japan in 1995, 2005, and 2012, respectively
  - Many equipment cannot be used due to deterioration
  - Advanced standard was not reflected due to absence of laboratory equipment
- Earned approximately 50,000$ per year from evaluation and certification projects (used as operating expenses)

TO-BE

- Modernization of experiment equipment and improve certification and evaluation system
  - Improve the independence of research institute through highly efficient operation
  - Reflect advanced standard through the performance evaluation

  ※ (Case) In case of the road research institute in Vietnam, spend 20,000$ per case as the certification and evaluation expenses for new technology and new construction method
- Expansion of sustainability through the presentation of excellent independence model
  - Infrastructure construction certification/evaluation model
  - Construction infrastructure full scale certification and evaluation model



Main contents of the project: CICT Pilot Project Execution

Cooperative Leading Project of Construction Technology in Cambodia

- Modernize road construction management system and construction standard
- Build a Construction Material Testing Lab
- Provide experiment materials and equipment & field investigation equipment
- **Sustainable Lab O&M**
- Capacity Building

Execution strategies

1. Test operation of functions (management, evaluation, certification, verification, etc.) of research institute of construction technologies in Cambodia
2. Verification of role of research institute of construction technologies in Cambodia and improvement of existing problems

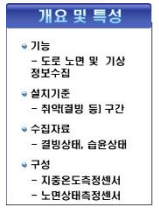
Verify the sustainable independence of research institute of construction technologies in Cambodia through pilot project

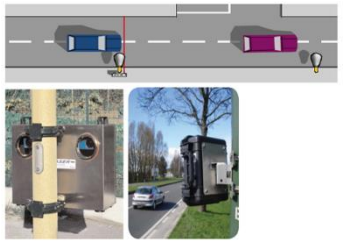
Test operation of research institute of construction technologies in Cambodia targeting National Road No. 2/22 or else

- Verify road designing and construction management, supervision, and evaluation system (PQMS)
- Verify the evaluation, certification, and verification systems necessary for road construction management
- Verify the maintenance system after the construction of road infrastructure (PMS)

Establishment of testbed targeting National Road No. 21 in Cambodia (MP establishment)

- Establish the testbed for the performance evaluation of road infrastructure in Cambodia (pavement, vehicle operation, ITS)
- Prove and verify new technologies and new construction methods through testbed operation (link to a profit-making project)





Main contents of the project: Capacity Building program

Cooperative Leading Project of Construction Technology in Cambodia

- Modernize road construction management system and construction standard
- Build a Construction Material Testing Lab
- Provide experiment materials and equipment & field investigation equipment
- Sustainable Lab O&M
- **Capacity Building**

Execution strategies

1. Reinforce the capability of professional manpower through systematic education
2. Prepare independent manpower supply system through the development of young talent

Reinforce the capability in road pavement field through education and training in Cambodia and Korea
Hold technical seminars and workshops for technical exchange and cooperation in the roadway field

Collection of opinions and demand survey

- Collection of opinions and demand survey in Cambodia for education programs (plan)
- Recommend Korean and Cambodia instructors for education program and assign subjects (Invite a Korean experts if necessary)

Curriculum

- Compose the curriculum based on specialized domestic road pavement construction education courses (Domestic mandatory education for road pavement)
- 4 categories and 21 detailed subjects

Subject (category)
Introduction to asphalt pavement
Asphalt plat facilities and mixing design for mixture, quality test
Construction of asphalt pavement
Quality management system for asphalt pavement

Education, training, and evaluation

- Invite trainees publicly through demand survey
- Target: Government officials, field workers (production and construction), university and graduate school students majoring in the fields of road

Promotion of seminars and workshops

- Hold local technical seminars and workshops for technical exchange in road field between Korea and Cambodia (once a year)
- Share issues and R&D results in road field between Korea and Cambodia
- Distribute advanced technologies in road pavement field jointly

Stage-wise Cooperation

The Cambodian government requested cooperative support as the highest priority

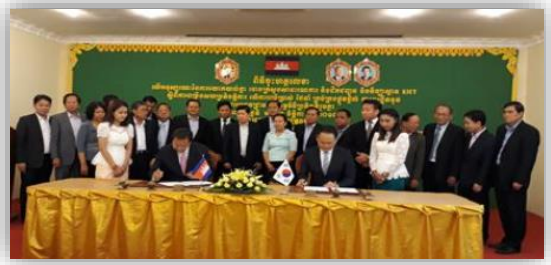
From 2016

Requests from the MPWT

- Modernize the infrastructure construction and management system and support the operation strategies of research institute of construction technologies in Cambodia
- Support the capability reinforcement programs

2017

- Conclude MOU for technical cooperation in national land infrastructure construction and supporting the test operation of research institute of construction technologies in Cambodia (KICT-MPWT)

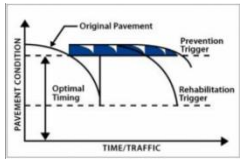


2018 ~

- Establish a local joint office for modernizing the national land infrastructure construction management system and establishing the test operation strategies of research institute of construction technologies in Cambodia
- MPWT's cooperative project in the highest priority.

(Phased) Modernization of road infrastructure construction and management and test operation of sustainable self-supporting research institute of construction technologies in Cambodia (Phase 1: Road field, Phase 2: Transportation field, Phase 3: Structure field)

Phase 1: Road field	Phase 2: Transportation field	Phase 3: Structure field
•Road pavement designing, construction, and maintenance & management	•Transportation operation, ITS, safety, and logistics management system	•Bridge, structural designing, and safety diagnosis, etc.



Stakeholder's Mutual Agreement

(September 2018) The Cambodian Minister of MPWT and the Korean MOLIT had a face-to-face talk at the **"ASEAN-ROK Infrastructure Ministers' Meeting"**

→ "Cooperative Leading Project of Construction Technology in Cambodia" was selected as the overseas cooperative leading project of the MOLIT

→ by the official agreement between two countries, the Cambodian government has high expectations regarding the promotion of the leading project.

Future Green-Growth Contribution

Country Partnership Strategy for the Kingdom of Cambodia

Transportation and Green Energy Infrastructure: Establish the basis of eco-friendly sustainable growth through the reinforcement of capability related to transportation and energy infrastructure construction.

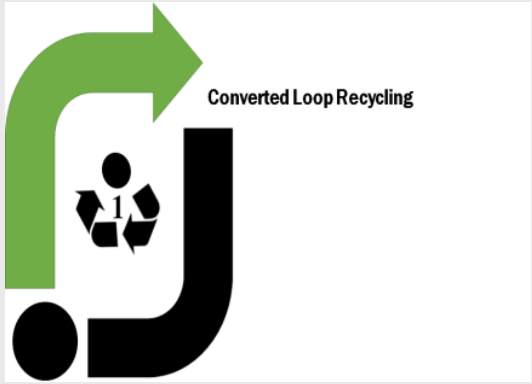
Sound Infra in Cambodia

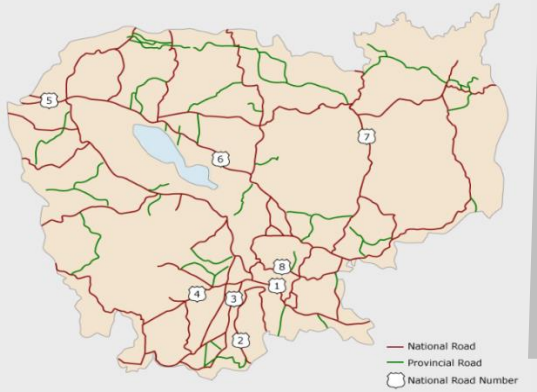
Efficient and modernized road construction management and continuous construction of sound road infrastructure

- Plans to extend the road for 300 km-400 km per year
- Implements the comprehensive transportation infrastructure development plan
- Japan and China increase investments in road infrastructure
- The road density is lower in comparison to that in surrounding countries and the road washout rate is high, so it is necessary to expand the road network additionally, road pavement ratio in local roads and improve the pavement status

(Pavement ratio of main roads - 10.2%, Road density - 0.3 per 100 ㎢)

Inclusive Growth through Innovation

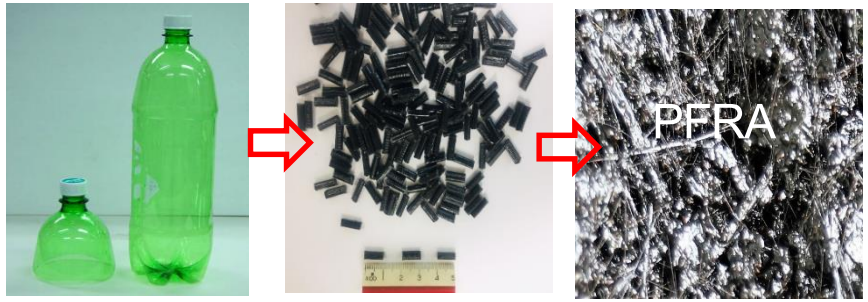


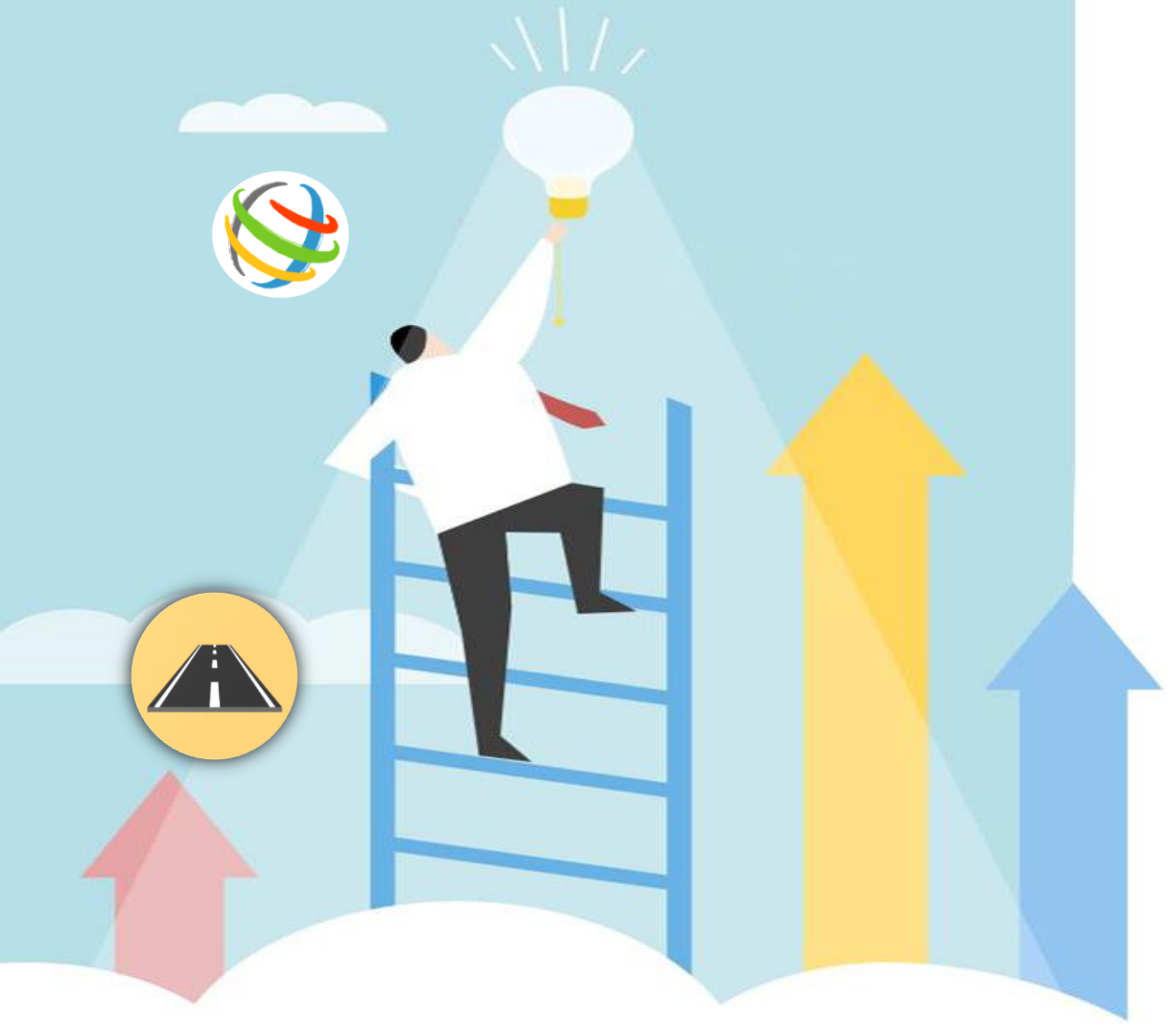


Green-Growth Technologies

Utilize Green-Growth Technologies to secure the competitiveness in National Road Infrastructure development projects

- SDGs Targeting Green-Growth Technologies
- Recycled Plastic Impregnated Fiber Reinforced Asphalt Concrete (PFRA): **S. Korea Patent [10-2257189/2021], U.S Patent [US 9944797 B2 /2018], China Patent [CN 106103375 B / 2019]**





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