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Chairperson of Board, Community Road Empowerment (NGO)
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How to Maintain the Rural Road by Ourselves

Civil Engineer
Geotechnical Engineering
Foundations, Tunneling, Retaining wall, New structures

2019 JICA
Tokyo Sky Tree  634 m high
Foundation
Earthquake force,  Wind force
New technology - Knuckle wall method -

Pile arrangement

Knuckle wall

Wall
Knuckle
Knuckle (bottom)

70m
New Structure for Viaduct
Crossing Sahara by bicycle (1984)

274-86-85
At the top of Mt. FUJI
What is a road for you?

Transport
Life
No development without a road
Access
Very important
Network
To carry farming products

To see the friends
Like water
Communication

Faida

Above those are the answers from the group members. “What is a road for you?”
Road in Africa
CORE IS INTERNATIONAL NGO.

Mission:

➢ Eradicate poverty in developing countries through road access improvement

Objectives:

➢ Empower local communities to improve road access to hospital, school, and markets
➢ Enhance self-reliance initiatives towards their own livelihood improvement

Strategy:

➢ Train communities on local resource and labor-based technology for road works through actual construction at the problematic sections where they suffer from difficulty of access
How do we repair rural roads without any machine?

What can I do for rural people as a Civil Engineer.

Challenges and Good Solutions

Vehicle per day < 50

September, 2007 Practical construction in East Uganda May, 2008
WHAT CAN WE DO?

PHILIPPINES

TANZANIA

MYANMAR

KENYA
COMMUNITIES SUFFERING
Poor access to school, hospital, and markets
Problems in rural area (Cause of the poverty)

Agricultural Community

- Can’t Transport Agricultural Product during Rainy Season
- Crops are spoiled
- Can’t get money
SOLUTIONS TO IMPROVE UNCLASSIFIED ROAD?

Road network in Kenya

Unclassified
98,950 km
Vehicle per day <100

Poor, 44%
71,345 km

Fair, 14%

Good, 3%

Contractor basis

Classified
61,936 km

Poor, 12%, 19,438 km

Fair, 20%

Good, 7%
Always waiting heavy machine!!

How to empower rural communities?
Approach to support communities to get better access to social services and markets

Better access
To School, Hospital, Markets
Road works
utilizing local resources
“Do-nou” technology

Opportunities
To be self-reliance, motivated towards livelihood improvement

Technical transfer
With/to communities, youth
STANDARD CROSS SECTION VIEW WITH DO-NOU METHOD

Do-nou: GEOTEXTILE
(Japanese term for soilbag)

Covering layer
\[ t = 50 \]

Do-nou 2 layers
\[ t = 200 \]

Prevent floodwaters from going over dikes

Building firm BASE
Surface layer
\[ t = 150 \]

Base
\[ t = 100 \]
Unit: mm

1. Locally available material
2. Labor based
3. Low cost
4. Low technology
“Do-nou” technology!!
Compaction
How to Generate the Strength of the "Do-nou"?

1. Soil is wrapped with bag
2. External force applied to "do-nou"
3. Tensile strength is generated.
4. The soil inside the bag is reinforced.

Mechanism is simple.

Do-nou is the ultimate geotextile.

Careful work (compaction) is necessary.
The people can repair the road by themselves. (Kenya)
Repair the road we own by participation of community members. (Ghana)
Characteristics of “Do-nou” 40 cm x 40 cm, 10 cm, 20-25 kg

Material

Plastic (polypropylene)

“Do-nou” bag ➙ Bags for sugar/maize

Material put inside the bag ➙ the site

Construction

Labor based

Simple

No curing period

Wooden mallet

Compressive pressure

Bearing Capacity (250 kN)

Low cost material

Soil near the site

Plastic  (polypropylene)  Bags for sugar/maize  Material put inside the bag  ➙ the site

Labor based

Simple

No curing period

Wooden mallet

Bearing Capacity (250 kN)
1952 Bridge construction in Japan
1957, National route 19th
Rehabilitation vs Spot Improvement

Not Maintainable

Rehabilitation
- International standard
- Year-round passable road
- USD 15,000 – 90,000 / km
- Contractor

Spot Improvement
- Local Resource Based Approach
- Almost Year-round passable road
- USD 5,000 – 20,000 / km
- Community initiative
- Micro & Small Enterprise

Do-nou method (Tech.)
ROAD IMPROVEMENT WITH LOCAL RESOURCE BASED APPROACH

- Rehabilitation
- Maintenance
- No intervention

Road condition

Spot improvement

Conventionally targeted standard

Rehabilitation

Spot improvement

No intervention

Current

Time
Voice of the people who experienced road maintenance using Do-nou

• Now I am confident I can maintain the road. Initially I was not very sure I could.

• I am very happy because the road has brought about good positive changes to our community.

• Initially I felt it was a difficult job needing a lot of energy but in the end I realized it was easy.

• In the beginning we did not have idea about maintaining roads but now we have learned.

• Big improvement of the road, I got knowledge.

• I have got technology, idea and murram road. I can do it by myself.

• I believed that the technology works on road maintenance.
IMPACT OF THE ROAD MAINTENANCE USING DO-NOU TECHNOLOGY

1. The buyers come to the village more frequently.
2. The price of the crops, vegetable and passion fruits, have raised.
3. The income of the farmers has increased.
4. The farmers were motivated and expanded their farm.
5. The farmers became able to reach the market more early in the morning, when the price was set more highly.
6. The extension officers visit the village more frequently, then the farmers get more skill and information of the markets from them.
7. The farmers started to new project for income generation, such as fish pond.
## Matrix for traffic, material, maintenance and cost

<table>
<thead>
<tr>
<th>Material put in bag</th>
<th>Purchase material</th>
<th>Available material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material in bag</td>
<td>Asphalt</td>
<td>Crusher</td>
</tr>
<tr>
<td></td>
<td>18/m³</td>
<td>4.4/m³</td>
</tr>
</tbody>
</table>

### Design Amount of Traffic

<table>
<thead>
<tr>
<th>Cross section</th>
<th>Material</th>
<th>Frequency of maintenance</th>
<th>Cost per meter (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 Unit:m</td>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Do-nou, 2 layers</td>
<td>8.3</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Do-nou, 2 layers</td>
<td>21.0</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Do-nou, 3 layers</td>
<td>28.5</td>
<td>Low</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency of maintenance</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost per meter (US$)</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>8.3</td>
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</tr>
<tr>
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<td>28.5</td>
<td></td>
</tr>
</tbody>
</table>

### Frequency of maintenance

- Low
- High

### Cost per meter (US$)

- Design Amount of Traffic:
  - 20
  - 100 (Per day)

### Traffic, Material, Maintenance, and Cost Matrix

- Frequency of maintenance:
  - Low
  - High

### Material Types

- Asphalt
- Gravel
- Murram
- Sand
- Clay

### Traffic Levels

- 20
- 100 (Per day)

### Frequency of Maintenance

- Low
- High

### Notes

- Target values are highlighted in blue.
- Unit: m
- Material in bag: 18/m³, 4.4/m³
- Frequency of maintenance: Low, High

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**Matrix Table**

<table>
<thead>
<tr>
<th>Design Amount of Traffic</th>
<th>Cross section</th>
<th>Material put in bag</th>
<th>Purchase material</th>
<th>Available material</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>3.0 Unit:m</td>
<td>Do-nou, 2 layers</td>
<td>8.3</td>
<td>18/m³</td>
</tr>
<tr>
<td>100 (Per day)</td>
<td></td>
<td>Do-nou, 3 layers</td>
<td>28.5</td>
<td>18/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Frequency of Maintenance**

- Low
- High

**Cost per meter (US$)**

- 51.0
Applications to Rural Infrastructure

- Retaining wall
- Culvert
- Dam (water harvest)

10 cm : Murram

Log A

Log B

“Do-nou” filled with Murram

150

70

50

20

10

50

80
With villager at 27 countries 165 km
CORE’s work in the worldwide, By Jun. 2019, 27 Countries

- **Gambia**
  - Côte d'Ivoire
  - Ghana
  - Cameroon
  - Burkina Faso
  - D.R. Congo

- **Ethiopia**
  - South Sudan
  - Somalia
  - Kenya
  - Uganda, Rwanda
  - Tanzania, Zambia
  - Mozambique, Madagascar
  - Bangladesh
  - Myanmar
  - Viet Nam
  - Philippines
  - Timor-Leste
  - Micronesia
  - Papua New Guinea
  - Solomon Islands
  - Tonga

<table>
<thead>
<tr>
<th>Region</th>
<th>Cent. A.</th>
<th>S. A</th>
<th>Africa</th>
<th>Asia</th>
<th>Pacific</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Coun.</td>
<td>1</td>
<td>1</td>
<td>16</td>
<td>5</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>Length (m)</td>
<td>0</td>
<td>20</td>
<td>53,597</td>
<td>30,500</td>
<td>90,604</td>
<td>174,721</td>
</tr>
<tr>
<td>No. of trainees</td>
<td>200</td>
<td>30</td>
<td>9,822</td>
<td>3,338</td>
<td>3,225</td>
<td>16,615</td>
</tr>
</tbody>
</table>
Case of road improvement with Do-nou in Kenya

Training/demo of unpaved road maintenance
L = 200 m W = 3 m, 25 person/day x 10 days, USD 9,000 /km
Concrete pavement at the steep slope with communities
L = 530 m W = 2.5 m, 30 person/day x 150 days, USD 100,000 /km
Standard cross section

Unit: m

Traffic:
- Bike, Bicycle
- 4WD (Ambulance)

Sharp curve portion

Retaining wall
- With Do-nou
- Filled with Soilcement

Backfill
- (Gravel)

Concrete ratio
- Cement : Sand : Gravel = 1:3:6

Concrete foundation

Granular soil

Concrete (t = 0.1)

Base, Gravel (t = 0.15)

Concrete pavement (t = 0.1)

Base, Gravel (t = 0.15)

Width
- 2.5 – 3.5

Shoulder
- 0.5 – 1.0

Unit:
- m

2.7

2.5

1

2

3.5 - 5.0

2.5

Traffic:
- Bike, Bicycle
- 4WD

Concrete foundation

Sharp curve portion
Granular soil

Concrete
(t = 0.1)

Base, Gravel
(t = 0.15)

Granular soil

Straight portion

2.7

2.5
Case of road improvement with Do-nou in Burkina Faso

Repair the damaged sections where was improved with Do-nou
Case of road improvement with Do-nou in Burkina Faso

Women willingly and proactively participated.
Embarkment built with “Do-nou” @ Myanmar

Sin Gu village

Do-nou laid under designed water level were filled with soilcement, other with in-situ soil

2,700 m, 150 days, 20 person
Unit Cost : USD 12,000/km

Before

Just after the construction

2015
Sustainability, Case at Shin Gu village in Myanmar

1. The heaviest flood in 10 years, in 2018
2. Cemented backfill
3. Damaged surface
4. Repaired by communities
Trainings at the field in Kenya

Available tools

Guidance for business

Team work
Road Problems to the Communities

Irrawady Division in Myanmar

① Falling accidents in rainy season because of slippery and muddy road surface.
② Bad road and bridge are Impassable for vehicles
③ No availability of suitable soil and stone for road maintenance because of Delta area.
Khan Thar village, Pyapon, Irrawady

Project period: October 2013 – October 2014
Design: Tire Path Concrete Pavement (Thickness 10 cm)
Length • Unit Cost: 1,200 m • 13,000 Kyat/m (13 USD/m)
Number of participants in average: 50 person/days
Number of Working days: 64 days
Traffic: Bike, Motorbike, Toraji

Population: 13,000
Cross Section

Do-nou filled with in-situ clay

Before

Concrete (Thickness 10cm)

Stone or Gravel

Backfill

Existing ground surface

After

60cm 60cm 60cm
Impact of the project

Travel time

<table>
<thead>
<tr>
<th>Traffic means</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>45 min.</td>
<td>17 min.</td>
</tr>
<tr>
<td>Bicycle</td>
<td>Impassable</td>
<td>8 min.</td>
</tr>
<tr>
<td>Motorbike</td>
<td>Impassable</td>
<td>4 min.</td>
</tr>
</tbody>
</table>

The motivated and trained community has repaired the other road by themselves.

1. The road become passable even in rainy season.
2. The patients are transported to the hospital timely.
3. Students are no longer hampered going schools due to the road conditions.
4. Some villagers started bike taxi business.
5. The community themselves repaired the other road with the fund donated by the other NGO in February 2015.
Bridge in Khan Thar

- Project period: October 2014 - October 2015
- Type of bridge: Reinforced Concrete Bridge
- Bridge Length: 20 m, 6 span, Maximum span length: 6 m
- Cost: 19,000,000 Kyat (18,900 USD)
- Number of participants in average: 40 person/days
- Number of Working days: 150 days
- Traffic: Bike, Motorbike, Toraji

This bridge was built with bamboos and very unstable. No motorbikes can pass.

Pedestrian bridge built with iron material
Sounding with local auger

Casting concrete for pile

Assembling steel bar

Form work for the beam
Before – View along bridge axis – After

Before – View from right-angle of bridge axis – After
Project period: October 2015 - October 2016
Design: Stone pavement with mortar
Length • Unit Cost: 240 m • 60,791 Kyat/m (46.5 USD/m)
Number of participants in average: 25 person/days
Number of Working days: 60 days
Traffic: 10 ton truck
Before
Do-nou (soil cement)

After
Stone and filling mortar
Big stone or soil cement
Good drain system remove the cause of the mud on the carriageway of road.

1. The community become more cohesive through the experience of working together on the road.
2. The repaired section become passable even in rainy season.
3. It takes fewer minutes to go to market and hospital than before.
Sustainability (Kenya)

Training for “Do-nou” technology (CHARITY)

Association formed for rural road maintenance

Recognition by the government

Improvement of rural road

Sustainable maintenance

Business Potential

CHARITY TO JOB CREATION
Formation of Association and Registered Company

Six Farmer’s groups that acquired “Do-nou” technology (Horticulture, Peace building, etc)

They formed an association for improvement of rural road accessibility (October 2010)

Bottom-up: Empowerment both organisational structure and planning & management

Top-down: Recognition of “Do-nou” technology at the government level

Association registered as a company (September 2012)
Training and Practice

- Empowerment of practical aspect
  - Cost estimation, construction planning
  - Management of plans and materials
  - Quality control

Empowerment of organizational aspect
- Executive committee, Accounting, etc

Bottom-up Approach

Top-down Approach

Recognition by the Government
BOP Business Model – Kenya Version

Benefit brought wider range

Contribution for starting business

Improvement of rural road
Benefit to the community people
- Improvement of accessibility
- Shortening time for travel
- Decreasing of transport cost, etc

Improvement of livelihoods

Japanese GV
International organizations
Ordering
Kenyan GV
Private sector

Community Road Empowerment (CORE) Kenya

Funding

Association (Registered as a company)

Design & Construction

Technical transfer
BOP Business Model – Kenya Version

Benefit brought wider range

Win-Win-Win Relation

Japanese GV → Community Road Empowerment (CORE) Kenya
International organizations

Win

Kenyan GV

Win

Government

Contractor

Win

Design & Construction

Ordering

Win

Community

Improvement of rural road
Benefit to the community people
- Improvement of accessibility
- Shortening time for travel
- Decreasing of transport cost, etc

Improvement of livelihoods

Contribution for starting business

Win

Win

Win

Win
Importance of Youth Employment

Youth employment is a crucial point

- No accessing to vocational trainings
- Unemployment for youths
- Increasing of idle youths
- Increasing of antisocial behaviour

Poverty and Unstable situations
Youth Employment for Sustainable Development

Joint Project with International Labour Organization (ILO)

Chairperson: Makoto KIMURA
Community Road Empowerment
### CORE’s Involvement in the ILO projects

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Project title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kenya</strong></td>
<td>2012</td>
<td>Youth Employment for Sustainable Development (YESD)</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td><strong>Somalia</strong></td>
<td>2014</td>
<td>Durable Solutions for Somali refugee returnees through Repatriation,</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>Assistance and Promoting Sustainable Livelihoods Project</td>
</tr>
<tr>
<td><strong>Gambia</strong></td>
<td>2018</td>
<td>Employment Creation for Youth to Build Sustainable Peace in The Gambia</td>
</tr>
</tbody>
</table>
Project Objective

To empower and create employment for youth groups by initiating Do-nou Technology for rural access road maintenance in the selected counties.
### Project Outcome Summary

**[From the youths]**

*We have skills.*

*Idle youths were reduced.*

*We learned moral with working together.*

*We got income.*

<table>
<thead>
<tr>
<th>Do-nou technology trainees</th>
<th>500 youths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructors trainees</td>
<td>20 youths (1 rep. from each group)</td>
</tr>
<tr>
<td>→ No. of groups who registered as companies</td>
<td>→ 11 groups</td>
</tr>
<tr>
<td>Distance of maintained roads (During trainings)</td>
<td>3,730 m</td>
</tr>
</tbody>
</table>
Project outcome – Improved roads

Before the training

After the training

The road situations were improved in 5 counties, 7 sites. (3,730m)
Project outcome – Create Employment

Companies registered 1 1 (as of March 2014)

Youth groups acquired some work after the project

❖ Supervision work from Kenya Rural Roads Authority
❖ Construction work costs several millions in Kenyan shillings
❖ Culvert installation and regular road maintenance work
❖ Part of work for 17 km paved road
The future of Africa hinges upon motivated young people who overcome difficulties through their own power.

Japan’s Diplomacy towards Africa: “Strengthening Each Individual, One by One,” Speech by Prime Minister Abe
121 Youth groups (2,424 members) trained
52 groups were trained at National training institute.
39 groups founded companies.
16 companies (30%) registered as qualified contractors.
20 contracts in total were received by the companies.
The contract amount in average is USD10,000.
Bottom up & Top down approach

Policy proposals to Local Authorities & Road Administrators/Line Ministry
A. Do-nou Demo, B. Budget allocations to the trainings for the youth
C. Manual & Guideline of Do-nou technology to be certified
AGPO Initiatives in Kenya

The Access to Government Procurement Opportunities (AGPO) initiatives is to enable youth, women and people with disability access 30% of Government Tenders through the process of registering and pre-qualifying Youths, Women and Persons with Disabilities owned enterprises.

Model: Series of Trainings on local resource based and labour intensive method to improve rural access roads to youth

Beneficiaries of AGPO Initiatives

What is a model? How effective?

Unemployment youth
Youth employment promotion model through trainings on Do-nou technology

Business activities
Utilize the AGPO *

Skills for road maintenance
Qualified upon graduation

Interested in road works
Entrepreneurship

No jobs, Dependent

Youth employment promotion

Receiving orders from Government

Registered contractors
Bid

National training institute
(6 weeks, USD1,750 /person)

Form a company

Do-nou training/demo

Do-nou training/demo
Encourage the entrepreneurship

Support saving the registration fee
Company registration

Policy proposal
500 youths to be trained*

Implemented by NGO
Executed by Government
Conducted by the youth

2015, $220,000, 120
2018, $370,000, 190
?, $370,000, 190
Solution to poor road/unemployment problem with benefit for all three sides

Inclusive business model developed through trainings to the youth on road maintenance using Do-nou technology

Government

Kenyan Government

✓ Achievement of Vision 2030
✓ Youth employment promotion
✓ Better road networks

Base of Pyramid

Community

✓ Access to markets/hospitals/schools

Win-Win-Win

Benefit of all the three sides

Enterprise

Local enterprise

The youth with skills

✓ Income
✓ Business

Placing orders

Services (Road works)
After the Do-nou technology training, my mind attitude changed. I am capable of working on construction sector. I can pay my basic needs, house rent and food for my family.
(Paul Njahia, Director, Eldo fist construction Co. Ltd)

I was jobless for 3 years and was hopeless to get job. During the Do-nou training, I was keen in learning the road skills. Now, awarded the tender from national and local government. I am happy man since I have married.

(Mike Kosgei, Director, Race-shine Co. Ltd)
“When I was jobless, I got the chance to participate in the Do-nou training. That had changed my life. “

After the training, he established his own company, which name is “Do-nou technology company”. 
Bringing a bright future to youth

A Japanese NGO called “CORE”, provides an excellent illustration of this.....

At HQ of African Union in JAN. 2014
### Further activities of CORE

#### Grant assistance from GOJ for 2019

<table>
<thead>
<tr>
<th>Country</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burkina Faso</td>
<td>4&lt;sup&gt;th&lt;/sup&gt; phase</td>
</tr>
<tr>
<td>Uganda</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; – 2&lt;sup&gt;nd&lt;/sup&gt; phase</td>
</tr>
<tr>
<td>Rwanda</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; – 3&lt;sup&gt;rd&lt;/sup&gt; phase</td>
</tr>
<tr>
<td>Myanmar</td>
<td>6&lt;sup&gt;th&lt;/sup&gt; phase</td>
</tr>
<tr>
<td>Kenya</td>
<td>World Bank etc.</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>JICA/JST Research project</td>
</tr>
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</table>

#### ILO project

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<tr>
<td>Mauritania</td>
</tr>
</tbody>
</table>
Employment Creation for Youth to Build Sustainable Peace in The Gambia

Gambia Technical Training Institute ≤ > KTC (Kisi Training Institute) in Kenya

Thankyou very much for your attention.
Bridge constructions
Field station 1 in Cameroon
Structure system
Make a good road for rural peoples!
Thank you for your attention!